FACTORS AFFECTING GAMBLING DECISIONS.

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Dedication

With deepest gratitude and love

to my mother

and

in loving memory of my father

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ABSTRACT

A comparison of the personality profiles of Gamblers Anonymous (GA) members, social gamblers and non-gamblers on the 16 PF, EPQ and Rotter's I-E Scale showed only that GA members scored significantly higher than both social gamblers and non-gamblers on the Neuroticism Scale of the EPQ.

Other factors considered to be influential in gambling decisions were investigated. There were no significant differences in the risk-taking behaviour of high compared to low locus of control subjects but the risk taken and the recall of gambling decisions by internals and externals were sensitive to information on luck. Although gambling was shown not to be a stimulus-bound activity in the traditional sense, the presence of gambling cues increased risk-taking in social gamblers but lowered risk-taking in non-gamblers. Reinforcement history, especially the ratio of the number of wins and losses, the immediately preceding outcomes and runs of wins and losses were shown to be influential in the staking behaviour and the confidence in gambling of both social gamblers and non-gamblers.

Personality and situational factors did not adequately account for the differences in risk-taking decisions. Physiological variations altered risk-taking within criterion groups. Moreover, different forms of arousal were shown to have different effects on risk-taking behaviour of social gamblers and non-gamblers. Significant interactions between arousal, gambling cues and reinforcement history suggested that a diversity of variables are important in determining gambling decisions rather than simply being under the control of economic or personality factors. There is some evidence which suggests that differences in levels of arousal may be

an important underlying factor in describing the differences between social gamblers and non-gamblers.

The repertory grid technique was explored as a research tool departing from the traditional methods of enquiry into gambling. The overall finding was that social gamblers construed gambling as a positive activity while non-gamblers construed gambling negatively.

Note to the reader

In this thesis the terms compulsive gamblers and pathological gamblers are used interchangeably although it is acknowledged that the term pathological is preferred since the term compulsive implies a particular abnormality which need not necessarily be present in gamblers (see Moran, 1968; 1970).

Most of the experimental subjects in this study consist of social gamblers and these are people who do not experience problems in their gambling. Some of them may be regular punters but, generally, gambling constitutes a recreational activity. When the term gambler is used without qualification it should be taken to mean a person who gambles, including the occasional and problematic gambler.

CHAPTER ONE

INTRODUCTION

It is commonly acknowledged that risks exist in many facets of life. While most people are content to cope with the social and physical risks there are others who deliberately seek out these risks. One interesting form of risk-taking which is not required in the individual's behavioural repertoire for survival is monetary risk-taking or gambling. The stock market and other business ventures are excluded from this category since these are given the benefit of the doubt that they may be required for income earning purposes. Monetary risk-taking, whether for recreational purposes or that of need fulfillment, is a very widespread behaviour, even in societies where the activity is not entirely legal (Herman, 1967; 1976a; Eadington, 1976; Dickerson, 1984).

For those people in whom gambling is a dominant feature of their lives, their persistence in the activity is impressive, but unfortunately, usually disastrous for the participant. Numerous studies have been carried out on people who are encountering problems associated with a preoccupation with gambling (see Lorenz, 1983). However, those who enjoy gambling for purely recreational reasons are largely ignored. The interest in these people has mainly been concentrated on their decision-making and other cognitive processes under various measures of risk. More often than not, an 'average' population (without any reference to the level of gambling participation) consisting of college undergraduates provides the subjects.

Nevertheless, much information regarding gambling behaviour has been obtained from these laboratory studies and other sociological surveys (Tec, 1964; Downes, Davis, David & Stone, 1976; Herman, 1976a).

To begin with, social gamblers come from all walks of life. In most societies there are no political, social, religious or racial barriers to social or for that matter pathological gambling, with the exception of certain religions such as Islam which prohibit the activity. Other religions, in an effort to raise funds, seem to encourage it, the prime example being the Catholic Church. Although gambling takes place in most societies in some form or another the Chinese and the Jews have often been singled out as the greatest gamblers. Cohen (1960; 1964; 1972) in his studies on gambling, uncertainty and psychological probability, often cites interesting historical and mythical instances of strange gambling practices. Herman (1967), Downes et al., (1976) and Li & Smith (1976) have shown that gambling is not restricted to any social class but the type of gambling preferred may be different within each class. On the whole, capitalist societies seem to dominate the world in per capita expenditure on gambling. The annual figures taken around the end of the 70's show Australia heading the list at A$710, USA at A$440, New Zealand at A$210, UK at A$95 and Canada at A$87. Some of the figures may be misleading in the sense that they represent the `turnover' (all the money wagered at a gambling event, including re-investments) rather than the actual amount of money spent (Choice, 1979; Consumer, 1981). Even then the figures are high. Unfortunately, no figures are available from socialist countries, a comparison with which, would be interesting.

Herman (1976b) hypothesised that competitiveness and chance-taking may be stimulated by the political order, especially in one where there are grave discrepancies in the distribution of wealth. In summary, the gambler may belong to any political and social stratum and, in many respects, is no different from the next person in the street.

Having decided who social gamblers might be we now turn to the question of where the gambling takes place. Horse-racing is a very popular 'sport' in many parts of the world. In New Zealand horse-race betting is the most common form of gambling followed by housie (bingo) and lotteries. The figures are very high and the increase in the amount of money invested is rapid. Tables A and B below give the amount of money invested in the two major form of gambling in New Zealand in the last 10 years.

Table A. The amount of money spent on lotteries and nett profit made from the sale of lotteries in New Zealand for the last 10 years.

Year	No. of draws	Gross proceeds ($)	Profits ($)
1975	*	14,800,000#	2,960,000
1976	*	13,065,000#	2,691,000
1977	*	16,065,000#	3,213,000
1978	65	21,200,000	4,367,000
1979	80	39,200,000	8,462,000
1980	86	57,700,000	11,039,000
1981	84	62,250,000	11,932,000
1982	*	55,930,000#	11,186,000
1983	*	62,215,000#	12,443,000
1984	*	87,910,000#	17,582,000

* Figures are not available, there were 50 draws in 1974. The Golden Kiwi Jackpot changed from 50 cents to $1 in 1977 and to $2 in 1980. These were the common ones which were on sale all the time (about 43 in 1974, 61 in 1978, 71 in 1979 and 72 in 1980) the rest were made up of $5, $10 and $20 lotteries which probably reached a peak in 1984. Although no figures were available the author estimated that there were about 100 draws of lottery tickets in the 1983-1984 calender year.

The Report of the New Zealand Lottery board did not always include the gross proceeds but from the ones available the profits amounted to between 19.8 to 20.6 percent of the gross proceeds. These estimated figures were arrived at by taking the profits as constituting 20 percent of the gross proceeds, hence the inconsistencies in years 1981 and 1983 (New Zealand House of Representatives Appendix to the Journals, 1974-1984).

Table B. Amount of money invested in horse- and dog-racing in New Zealand in the last 10 years and the amount of profit derived from the races by the Totalisator Agency Board over the same period of time.

Year	Total ($) (on- and off-course betting)	Profits ($)*
1975	266,576,000	25,058,000
1976	321,604,000	30,231,000
1977	366,703,000	34,470,000
1978	402,506,000	37,836,000
1979	464,696,000	43,681,000
1980	502,210,000	47,208,000
1981	534,540,000	50,247,000
1982	606,047,000	56,968,000
1983	671,810,000	63,150,000
1984	729,534,000	68,576,000

From the above figures it can be seen that in the last decade the amount of money invested in gambling increased from $281,376,000 to $817,444,000, nearly a 3 fold increase. Looking at it in terms of profits the amount increased from $28,018,000 to $88,158,000 more than 3 times the amount 10 years ago. Keeping in mind that these figures represent only the two major gambling outlets the total amount of money wagered by a population of 3 million New Zealanders is an imposing figure. For this reason alone the study of gambling is well justified.

A number of approaches have been taken to the study of gambling. Gambling has been interpeted in learning terms (Ferster & Skinner, 1957; Skinner, 1953; 1972; Levitz, 1971; Knapp, 1976; Dickerson, 1977b; 1979). Most of these accounts have applied learning principles to specific features of each

type of gambling activity with some success. The primary emphasis has been given to explaining the reinforcing attributes of money and identifying the various schedules of reinforcements which control gambling behaviour. An over-emphasis on monetary concerns may lower the credibility of the behavioural framework since, as will be discussed later, it is accepted that a number of other non-monetary factors seem to have powerful reinforcing qualities.

As might be expected, psychoanalytical explanations of gambling (Lindner, 1950; Greenson, 1947; Freud, 1953, Bergler, 1957; Galdston, 1960; Halliday & Fuller, 1974), focussed on unresolved childhood conflicts. For many psychoanalytic authors, losing is the punishment that alleviates the guilt feelings associated with infantile sexual desires. Gambling is also frequently regarded as the functional equivalent of other addictions (Galdston, 1960; Adler, 1966; Adler & Coleman, 1969). Freud (1953) suggested that gambling is derived from the primal addiction, masturbation, while Halliday & Fuller (1974) described gambling as one of man's `universal neuroses'. Need for approval, hence testing fate by taking chances in gambling, constitutes a major part in the psychoanalytic description of gambling (Lindner, 1950; Galdston, 1960). There are two major objections to these psychoanalytic explanations of gambling. Firstly, most of these explanations are speculative with little or no supporting data to back up the hypotheses. Secondly, as with scientific evaluations of psychoanalytic hypotheses, they have been considered to be untestable and irrefutable (Popper, 1963).

In more recent times, phenomenological explanations of gambling began to find favour among investigators in the

gambling field (Livingston, 1974; Kusyszyn, 1976; 1977; Knowles, 1976; Campbell, 1976). Much of the theorising arose as a result of dissatisfaction with learning, and especially, clinical approaches towards gambling. The main contention from these authors is that, instead of viewing gambling as a sick and/or abnormal behaviour, it should be considered a normal activity for most people and that it provides a healthy outlet for daily frustrations. Furthermore, it serves the function of play and recreation and gives hope for wealth without the necessity of over-risking. Other psychological advantages of gambling include an increase in self-esteem, self-efficacy and self-worth associated with successful gambling. This author would like to speculate that through experience in gambling the individual may learn to have less attachment to money and, from a history of winning and losing as is typical of sports encounters, the individual may have an opportunity to acquire a more realistic attitude to life and greater tolerance towards failure.

Gambling, like most other phenomena, has also been interpreted from a sociological perspective (Caillois, 1962; Devereux, 1968; Oldman, 1974; 1978; Herman, 1976a). Most of these accounts discussed the sociological functions provided by gambling in society (Herman, 1976a,b) or a subset of society (Zola, 1963). Similar to the phenomenological approach, these explanations have generally avoided labelling gambling activity as `sick' but instead generally argue that gambling fulfills some form of social need for those who gamble.

No single approach has been entirely satisfactory in accounting for all forms of gambling (Cornish, 1978).

Learning theories have generally ignored cognitive aspects involved in gambling and the individual differences in motivation for gambling but emphasised mainly the situational determinants of the initiation and maintenance of the gambling activity. All the remaining orientations tend to suffer from an over-inclusion of too many forms of gambling in the explanations, thus making unreasonable generalisations. Another major problem with most approaches is the difficulty in testing the hypothesis implied by the theories. This author asserts that most researchers would agree that different forms of gambling have different characteristics and require diverse strategies for success. Bearing this in mind, and the fact that factors initiating gambling activity need not necessarily be the same as those maintaining gambling activity (Cornish, 1978), any all encompassing theory of gambling behaviour will be likely to involve more than one causal factor. The present trend of research into gambling seems to suggest that a more eclectic approach is most fruitful (Anderson & Brown, 1984; Smith & Preston, 1984; Wagenaar, Keren & Pleit-Kuiper, 1984). There are, nevertheless, still many problems to overcome, the most obvious of which, pertains to the how, how much and why of the contribution of the various `forces' influencing gambling behaviour.

A number of researchers in gambling have concentrated more on the empirical demonstration of the `risk-taking' propensity of individuals under conditions of varying probabilities of winning and losing and the amount of money to be won or lost. The simplest model for decision-making under risk is the `expected value' model where it is assumed that the decision-maker will choose between bets andwhether

to bet at all, by using the maximisation of expected gain as the criterion (Edwards, 1955). The expected values for each alternative bet are calculated by multiplying the value of each of its outcomes by its probability of occurrence and summing these products over all the outcomes (Pruitt, 1962). The model is useful where the individual involved is primarily motivated by rational economic concerns and where all the objective values of the probabilities and payoffs are known, but these gambling parameters are frequently absent. Other weaknesses of the model include individuals accepting bets with a negative expected value even if this is the alternative to not gambling at all and subjects have been shown to ignore information on expected value even when given the opportunity and encouraged to use such information (Lichtenstein, Slovic & Zink, 1969). Pruitt (1962) showed that when expected value is held constant subjects may display preference for one bet over another.

Mosteller & Nogee (1951) presented some evidence for an `expected utility' model which explained some of the discrepancies not dealt with by a simple expected value model. The monetary values of payoffs are replaced by the individual's evaluation of their utility. In traditional economic theory, successive increments of money take on a diminishing utility which implies that even in the case of `fair' bets the satisfaction to be gained from winning extra money should by definition be less than the satisfaction to be forfeited should the same amount be lost, emphasising the apparent irrationality of gambling (Cornish, 1978).

Improvements were made to the original models by using subjective estimates of the parameters rather than the objective values. The `subjectively expected value' model

was proposed by Edwards (1955) to account for some inconsistencies in his earlier model. The most sophisticated model was that of the `subjectively expected utility' model in which the utilities of the probabilities and payoffs were assigned subjective values (Rapoport & Wallsten, 1972). Overall, expectation theories have not had much success at providing explanations for many types of gambling but are adequate for simple forms of gambling such as lotteries (Weinstein & Deitch, 1974). The different types of gambling require different gambling behaviour and individual differences within the same type of gambling will probably make the search for a general rule of gambling quite difficult. Besides, factors other than economic are likely to play a large part under certain conditions.

A number of investigators have identified some factors which influence the gambler's evaluation of probabilities and payoffs. Tversky & Kahneman (1974) described 3 major heuristics employed by people to assess and predict values, which under certain circumstances tend to lead to biases; 1. the representativeness heuristic, 2. the availability heuristic and, 3. the `adjustment from an anchor' heuristic. The perception of the amount of skill or chance involvement in the game has also been shown to have an effect in the assessment of the probabilities and payoffs of the gamble (Andriessen, 1971) and the amount of risk taken (Lupfer & Jones, 1971; Littig, 1962). A related bias appears in the amount of control the individual has on the outcome. Gamblers stake more money before the dice has been rolled than after the fall of the dice even though the results are unknown (Strickland, Lewicki & Katz, 1966; Rothbart & Snyder, 1970). Langer (1975) suggested that the presence of

skill-related factors in chance situations may cue or encourage the individual to have an `illusion of control'. In gambling situations, the illusion of control which results misleads the gambler about his/her chances of success, and the consequences of this deception will depend upon the extent to which skill (as opposed to chance) does, in fact, influence the outcomes.

A series of studies in subjective probability by Teigen (1983a, b, c, d) illustrated some of the errors of human judgement in uncertain events. His results show that guessing behaviour is subject to grouping, anchoring and contextual effects. The major strategy in guessing seems to be an avoidance of numbers with prominent, `non-random' properties, which, at the same time, are highly available to the subjects. Most subjects prefer to be consistent rather than being `rational', making the final prediction is dependent upon the order in which decisions are made. Most subjects seem to have adopted a non-distributional conception of probability, that is, when more than 3 alternatives are available the probablities of all the events do not add up to unity. Confidence is closely related to perceived chance, but not to the subjective probability of the event in question, except when all outcomes are judged equally due to chance. The difference between the terms `chance' and `probability' used in this context is that, in common language, outcomes are sometimes said to be `caused' by chance (Teigen, 1983d) while probability refers to the likelihood of an event occurring. Subjective and statistical conceptions of uncertainty have partially opposing connotations. `An uncertain future' seems to be subjectively interpreted as an open future, with freedom of hope and

belief, rather than the statistically unreliable future, with restricted possibilities of prediction. Lichtenstein, Fischhoff & Phillips (1982) concluded that the general finding of the `calibration' of subjective probability estimates studies is that people tend to be over-confident, that is, they exaggerate their probabilities of being correct. These results and others from Kahneman, Slovic & Tversky (1982) and their associates on judgement under uncertainty have relevance to the present gambling research. However, the topic is too vast to be reviewed in this chapter. Many of these judgemental and statistical biases have effects on gambling decisions and these will be discussed along with the appropriate experiment.

Another source of bias which is particularly relevant to gambling decisions can be referred to as the belief in luck or superstitions. The bulk of research in the area of luck has been carried out by Cohen and his associates. For example, their results show that the belief in the probability of occurrence of an outcome is increased or decreased depending on how lucky or unlucky a person feels respectively, compared to when the individual is feeling neither lucky nor unlucky. These are further influenced by the perceived difficulty of the task. In addition, a preference for relying on skill or chance when gambling is not absolute but is affected by the probability of success. Some of the belief in luck is transformed into superstitious practices gambling. Henslin (1972) described the superstitious ritual in which crap players engage in apparently trying to influence the fall of the dice. In Jahoda's (1970) analysis of superstition, he noted that the inveterate gambler is `notoriously superstitious'. Luck and

superstition have been so closely associated with gambling in ordinary life that a description of those terms usually precede any discussion of gambling. Devereux (1968) further noted that in contemporary, rationally oriented societies, gambling appeals particularly to superstitious persons, and it is one of the few areas in which permissive attitudes towards superstition are tolerated. In spite of that, little attention has been given by the scientific community to those 'forces' operating on the individual under conditions of risk, especially monetary risk-taking.

In general, relatively little effort has been given to investigations concerning non-economic factors influencing decision-making under risk or other gambling situations. There have been two major theoretical approaches; one, a learning theory perspective, and secondly, an emphasis on personality characteristics. In terms of personality, the bulk of the research has concentrated on compulsive or pathological gamblers. Locus of control, extraversion, neuroticism and impulsivity are some of the most common traits that have been investigated individually. The highest agreement, thus far, has been that compulsive gamblers are more external and score higher on the neuroticism scale. Other studies have yielded more conflicting or, at least, non-replicated results. The few learning theory interpretations of gambling have been consistent, which is expected since most accounts have been post hoc assignments of behavioural units to the different components of the gambling situation. A number of researchers have argued for the behavioural analysis of gambling behaviour (Dickerson, 1977b; 1979; Knapp, 1976; Saunders & Wookey, 1980). Besides the treatment of compulsive gambling by aversive means

(Barker & Miller, 1966; Goorney, 1968) other less physically painful methods have been employed with success (Fitchett & Sandford, 1976). Although the behavioural approach seems to be a more profitable one to take, the existence of individual differences and their influences on gambling cannot be denied (Cornish, 1978) and as Williams (1977) pointed out, the potential influence of such personality variables has yet to be investigated.

The other major approach to gambling, which probably belongs more to the study of decision-making, is the information processing model. These models seem able to integrate results from a wide variety of experiments (Lichtenstein et al., 1969; Slovic & Lichtenstein, 1968a; Payne & Braunstein, 1971). The information processing model is relevant to gambling behaviour because of the emphasis on the importance of correctly identifying the sources of information actually used by the decision-maker. Quite often only restricted information is available and in many instances the gambler may be persuaded or misled into paying attention to one dimension rather than another. Information may also be presented in many ways, aurally versus visually or sequentially versus simultaneously. The inclusion of selective attention to particular risk dimensions and other stimuli will improve the descriptive and predictive power of the models. The study of the actual strategies employed by gamblers throws light on their perception and importance-beliefs. The determinants of these factors and the methods by which information processing techniques can be deliberately manipulated will further specify the importance of certain gambling parameters.

There are a number of contentious issues which beset

many areas of gambling research. One which is common to most social investigations is the applicability of laboratory findings to real life. The bulk of research in monetary risk-taking has been carried out in the laboratory. In nearly all cases the stakes for betting and the range of gambling games that are available are severely limited. The restriction of stakes is an important constraint since quite a number of studies use the size of bets placed as a measure of risk-taking thereby introducing the possibility of biasing the results. However, Lichtenstein & Slovic (1973) showed that the strategies employed by laboratory subjects are replicable in a casino setting. On the other hand, Anderson & Brown (1984) presented results which cast doubt that laboratory gambling could be used as a valid analogue of the real gambling situation.

A related objection is that, more often than not, the laboratory `gambling' is treated as an isolated event which is hardly ever the case in real-life situations. The motivation for gambling may play an important part in determining the level of risk taken and the gambling strategies employed. This is especially serious when it is highly unlikely that motives for gambling for volunteer subjects (largely from a student population) are similar to those who visit the race-track or the betting office. Situational factors such as the range of physical and social cues which are normally present in a gambling scene are usually absent in laboratory settings. Otherwise, experimental risk-taking and gambling studies enjoy the same advantages as other controlled social research in the laboratory (Lewin, 1979).

It was mentioned earlier that the majority of the few

studies on the characteristics of gamblers have concentrated on compulsive gamblers, and more often than not those subjects have been recruited from Gamblers Anonymous (GA). Dickerson (1984) has argued that no significant differences have been demonstrated between this group of problematic gamblers and other equally high frequency gamblers who do not seek treatment. Also there has not been any differences demonstrated between compulsive gamblers and social gamblers (Malkin, 1981, cited in Dickerson, 1984). As a deviation from the trend it was decided that it may be of theoretical interest to investigate the characteristics of social gamblers and people who enjoy gambling but do not over-indulge in the activity. A number of features have been ascribed to this group of social gamblers without much supporting evidence. A comparison of the performance of social gamblers versus non-gamblers has rarely been carried out. The most prominent model of the progression from a 'normal' person to that of a compulsive gambler includes a phase where the individual may be described as a social gambler (Custer, 1982). Thus it is rather surprising that little effort has been devoted to research other than the final stages of compulsive gambling. It has also been quite fashionable to specify one or two underlying causes of the proclivity to gamble but in most instances these are merely speculations and conjectures.

The major aim of the present thesis is to investigate the characteristics of social gamblers. For the most part, these gamblers are compared with non-gamblers rather than compulsive gamblers. A more detailed inquiry is directed towards a number of contradictory areas and other commonly cited but unsupported assertions.

To begin with, an assessment of the personality characteristics is carried out on a group of compulsive gamblers, social gamblers and non-gamblers taken from an adult non-student population. The personality measures used are slightly different from the usual trend of employing tests of specific traits in that the Cattell 16 Personality Factors is used which represent a non-clinical measurement of personality. The Eysenck Personality Inventory and the Rotter's Internal-External Locus of Control Questionnaire are also included to get a more complete picture and in an attempt to replicate previous results. A more detailed investigation of the locus of control construct follows the personality study. High and low scorers on the locus of control scale are compared on a number of risk-taking and gambling related dimensions. One of the main purposes of the exercise is to test the assumption of the riskiness preferred by internals and externals.

A frequently stated characteristic of gamblers, that of their being easily influenced by external stimuli is examined from the perspective of gambling as a stimulus-bound behaviour. Gambling activities are rarely carried out in isolation from social or physical stimuli. One feature which has received some attention is the influence of the presence of other gamblers (Blascovich, Veach & Ginsburg, 1973; Blascovich & Ginsburg, 1974; Blascovich, Ginsburg & Howe, 1976). Another concomitant feature, the importance of gambling cues in actual monetary risk-taking, is explored. This aspect of gambling has surprisingly been ignored considering that commercial enterprises have taken advantage of its effects for some time. Another inexplicable feature of gambling research is that very few investigators seem to

acknowledge the fact that most gambling activity is sequential and that few people take less than 5 gambles during a gambling bout. There are also contradicting reports on the importance of the outcome of previous bets on the staking behaviour of the next bet. Related to this, the reinforcement history, a feature that is hypothesised to be influential in determining the staking behaviour is assessed. Finally, as a prelude to testing for arousal as a basis for explaining the participation in gambling activities, two different kinds of arousal are introduced. This also allows a comparison of the potency of such arousal in gambling situations.

The final empirical section of the thesis is devoted to examining a new technique in the study of gambling behaviour. In order to overcome the deficiencies of laboratory studies and the difficulties of field studies it is suggested that the cognitive aspects of gambling may be investigated by using the repertory grid technique. The versatility and applicability of the method is explored. Since luck and superstition have commanded such a prominent place in the gambling literature, an attempt is made to analyse their influence in gambling for those participating.

In the concluding chapters the results of the experiments are then discussed in the context of the overall thesis and some suggestions for future research are provided.

CHAPTER TWO

PERSONALITY CHARACTERISTICS OF PATHOLOGICAL GAMBLERS, SOCIAL GAMBLERS AND NON-GAMBLERS

Introduction

The analysis of the gambler has been made the object of numerous studies by novelists and moralists and has served as a popular theme for the theatre, but empirical studies have been relatively scarce. Among the research carried out the emphasis has been on two aspects of individual differences in relation to gambling behaviour: 1. a basically hypothesis-free comparison of gamblers and non-gamblers on a wide variety of personality and attitude measures and, 2. an examination of traits which might be expected to account for individual differences in their dispositions to gamble or decision-making in gambling (Cornish, 1978). While it is acknowledged that the attribution of the cause or maintenance of gambling to personality factors cannot be precisely determined it is, nevertheless, a useful starting point for the investigation of differences among criterion groups.

In what was probably the first empirical study on the personality characteristics of gamblers, Hunter & Brunner (1928) administered the Bernreuter Personality Inventory and the Colgate Introversion-Extraversion Scale to a large number of avid college gamblers but found no common constellations. In another psychometric study, McGlothlin (1954) tested women poker players and showed that the gamblers scored better on the social, home and emotional sections of the Bell Adjustment Inventory than the norms for the general female

population. Those who scored poorly on the emotional section also tended to believe in luck and superstitions rather strongly but did not take more risks than the better adjusted individuals. Morris (1957) classified 29 avowed college gamblers into 3 categories; thrill, economic and other, using Gough, McCloskey and Meehl's Scale for dominance and social responsibility, the Gough Scale for psychological feminity and the Maslow, Hirsh, Stein and Honigman Test for security-insecurity. Gamblers were found to be more secure, dominant, masculine, but less responsible and exhibited a greater discrepancy between inner and outer selves.

Probably due to the inception of Gambler's Anonymous (GA), a self-help organisation for pathological gamblers modelled after Alcoholics Anonymous, in 1957, later personality investigations have concentrated on pathological gamblers who are members of GA. Roston (1961) found that pathological gamblers are more hostile, aggressive, rebellious, socially alienated, magical in their thinking, less able to learn from experience, and show more obsessive and compulsive thinking on the Minnesota Multiphasic Personality Inventory (MMPI) and a slightly modified version of the Rotter Level of Aspiration Board. In addition, Moran (1970a) showed that pathological gamblers have higher external and neuroticism scores on the Social Reaction Inventory and the Eysenck Personality Inventory (EPI) compared to the norms of the respective tests. More recently, Dell, Ruzicka & Palisi (1981) using the Millon Multiaxial Clinical Inventory (MMCI) revealed that GA members, in comparison with Millon's normative sample, are more gregarious, narcissistic, aggressive and drug abusive, but significantly less conforming and depressive. Wong

(1980) found that GA members scored high on the extraversion scale of the EPI and were more external on the Social Reaction Inventory but were within the normal range for impulsivity. Malkin (1981, cited in Dickerson, 1984) found no differences between GA members and social gamblers on any measure in the Myers-Brigg Locus of Control Scale. Both Seager (1970) and Blaszczynski, McConaghy, Armstrong & Allcock (1982) showed that compulsive gamblers scored higher than regular off-course bettors on the neuroticism scale of the EPI.

In a study comparing the personality characteristics of heavy gamblers, light gamblers, non-gamblers and lottery players, Kusyszyn & Rutter (1978) found that the two groups of gamblers take more risks than both non-gamblers and lottery players put together. The relationship between risk-taking and the other attributes measured including; effectance (Kusyszyn, 1976), hostility and aggression (Jackson, 1967; 1971) was the same for all the four groups.

Kusyszyn & Rubenstein (1971) found that race-track gamblers are significantly more external than the norms of the Rotter's I-E Scale. Using their Race Track Betting Behaviour Questionnaire the authors were able to classify the gamblers into four sub-groups: 1. the rational gambler has a confident, practical, rational internally-controlled approach to gambling, 2. the social gambler is carefree and fun loving, bets on every race, believes in luck, and goes to the track to enjoy himself, 3. the pathological gambler attends races regularly, bets on every race, bets more money when losing in order to recover his losses and feels badly after having an unsuccessful day and is externally oriented and, 4. the systems gambler goes to the track to relax and bets

according to a system without regard to luck. Kusyszyn & Rubenstein suggested that three of the four behaviour patterns are similar to those of the poker players described by Martinez & LaFranchi (1969). The other major study on the personality of race-track gamblers was carried out by Conrad in 1979. A number of tests were used including; the Rotter's I-E Scale, Crowne-Marlowe Social Desirability Scale and the S-R Inventory of Anxiousness. His results indicated that the pathological gambler has a lower level of defensiveness than the social gambler, but exhibited a higher level of anxiety and race-track gamblers are more externally oriented than non-gamblers.

The sparse research in this field has produced inconclusive and, at times, contrary results. The present study attempts to further explore and clarify the personality characteristics of pathological gamblers and social gamblers. As a variation to the usual procedure a standard non-clinical personality test- the Cattell's 16 Personality Factor Questionnaire (16 PF)- was used. The Eysenck Personality Questionnaire (EPQ) was included to assess its usefulness as a descriptive tool with respect to gamblers and whether Moran's (1970a) results could be replicated by using a shorter version of the EPI. The Rotter I-E Scale was used to examine the locus of control of gamblers and non-gamblers. In general, the previous results have indicated that gamblers are more defensive, hostile, aggressive and have a higher level of anxiety than non-gamblers. Gamblers also appear to believe more in luck and superstition and were shown to be externally oriented.

If the disease conception of pathological gambling espoused by Gamblers Anonymous is accepted then one would

expect the scores on most of the relevant scales to lie on a continuum with non-gamblers and GA members (pathological gamblers) situated at the extremes and social gamblers (social, non-problematic) in between. Thus, in line with previous research and the questionnaires used in this study, GA members, and to a lesser degree social gamblers, were expected to be more tense (Q4), apprehensive (O), suspicious (L) and affected by feelings (C) compared with the control group of non-gamblers, as measured by the 16 PF. GA members and gamblers were also expected to score higher than non-gamblers on the P (insensitivity and hostility) and N (worrying) Scales on the EPQ, and on the Rotter I-E Scale the two groups of gamblers were expected to have a higher external score than non-gamblers.

Method

Subjects

Twenty male non-gamblers were recruited randomly from ten different suburban areas of Christchurch City to serve as control subjects, selected from every fiftieth home in the telephone directory. This non-gambler group was defined as those who bought only raffle or one dollar lottery tickets or had gambled less than once a year. Individuals who gambled at least once a week or wagered over an average of 10 percent of their weekly gross income were defined as gamblers. The gambler group was made up of 24 volunteers from a total of 32 males, randomly approached during an ordinary race-track meeting. The third group consisted of a further 12 pathological gamblers who were members of the Christchurch Gamblers Anonymous (GA members) including three recruited from members of the GA group in Wellington. This group consisted of self-admitted compulsive gamblers who had joined a self-help organisation to alleviate their gambling problem.

Only male subjects were used since there was a notable absence of females in the GA groups approached and because the different orientations of gender towards gambling activities (Downes et al., 1976) might introduce further variance to the results.

Tests

Each subject was asked to complete five questionnaires. The Cattell 16 Personality Factors (16 PF) and the Eysenck Personality Questionnaire (EPQ) were used to explore possible personality differences between the three groups of subjects

and the Rotter Internal-External Locus of Control Scale (I-E Scale) was used to determine locus of control. The problems associated with gambling were assessed by the Gamblers Anonymous Gambling Questionnaire (GAGQ, see Appendix 1) which consists of a set of 20 questions similar to those in the Michigan Alcohol Screening Test. The extent of gambling participation was measured by a Gambling Behaviour Questionnaire (GBQ, see Appendix 2). The GA group was not required to fill in the GBQ since the major purpose of the questionnaire was to decide the allocation of the subjects into the respective groups and GA members automatically qualify as pathological gamblers. Furthermore, it was an attempt to avoid embarrassment since members of GA are required to abstain from gambling as part of their self-help therapy programme.

Procedure

All the non-gambler subjects were approached in their own homes and asked if they would take part in a gambling survey. Although both the gambler and pathological gambler groups were contacted elsewhere they were all tested individually in their own places of residence. The nature of the tasks was then explained. If the subjects expressed their willingness to participate they were presented with the two gambling questionnaires (GAGQ and GBQ), followed by the 16 PF, EPQ and I-E Scale. Only about 25 percent of all the people solicited declined to participate. Six subjects completed the EPQ and I-E Scale without the author present and returned them by post. One non-gambler, six social gamblers and four pathological gamblers did not complete the 16 PF and, five social gamblers and one pathological gambler

failed to complete the EPQ.

Results

A t-test carried out on the GAGQ data to compare the extent of the problem experienced by gamblers and GA members due to their gambling activities was highly significant ($t = 6.36$, $df = 32$, $p = .001$). The GAGQ scores were analysed separately since it was only relevant to gamblers and GA members. The mean number of positive responses to the questions for gamblers was 4.0 and 12.5 for pathological gamblers (seven positive responses or more to the 20 questions is indicative of problematic gambling according to Gamblers Anonymous Organisation). As expected, GA members felt that gambling was more problematic to them than gamblers. It should also be mentioned that in the course of about one and a half years attendence (fortnightly) at GA meetings the author observed that GA members, in their gambling days, gambled more heavily and frequently than the gamblers in this sample.

A multivariate analysis of variance (MANOVA) was carried out separately on the four scales (P, E, N and L) of the EPQ, the 16 factors of the 16 PF and the Rotter I-E Scale. Each personality factor or scale was treated as a variable. The mean scores on each of the variable for the three groups of subjects are presented in Table 1.

Table 1. The mean scores of non-gamblers, gamblers and pathological gamblers on the 16 PF, EPQ and Rotter's I-E Scale.

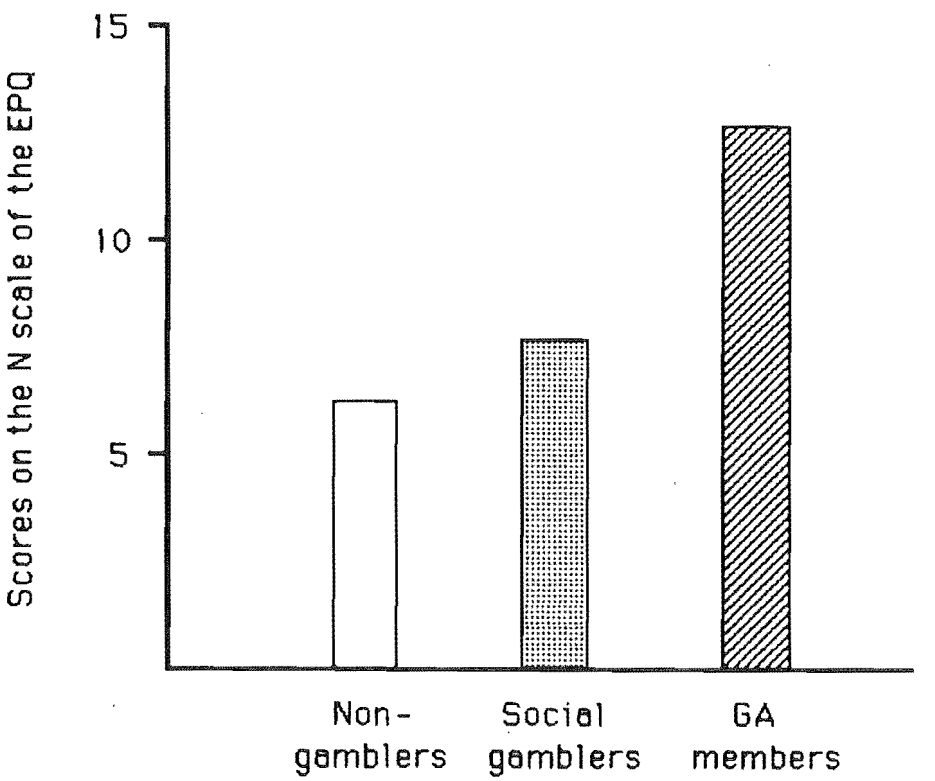
Factor	Description	*N. Gam	S. Gam	P. Gam
A	Reserved/Out-going	5.4	6.1	5.5
B	Less/More intelligent	7.5	7.7	6.6
C	Aff by feelings/Emot stable	5.1	4.4	5.5
E	Humble/Assertive	5.2	5.6	4.8
F	Sober/Happy-go-lucky	5.1	6.1	5.4
G	Expedient/Conscientious	5.0	5.1	5.0
H	Shy/Venturesome	5.4	4.8	5.6
I	Tough-minded/Tender-minded	5.1	5.0	5.4
L	Trusting/Suspicious	5.1	5.4	4.8
M	Practical/Imaginative	4.9	5.8	5.6
N	Forthright/Astute	5.0	4.7	5.0
O	Self-assured/Apprehensive	5.6	5.4	6.6
Q1	Conservative/Experimenting	6.9	5.5	5.4
Q2	Group-dependent/Self-suff.	6.8	6.0	6.0
Q3	Self-conflict/Controlled	6.4	5.7	4.9
Q4	Relaxed/Tense	5.5	6.1	4.5
P	Psychoticism	3.6	3.9	5.6
E	Introversion/Extraversion	12.7	12.3	14.0
N	Neuroticism	6.9	7.7	12.6
L	Lie	7.6	8.9	5.7
R	Rotter's I-E	8.3	11.5	8.9

*N. Gam = Non-gamblers,
S. Gam = Social gamblers,
P. Gam = Pathological gamblers.

The MANOVA (output in Appendix 3) for the 16 PF data did not reveal any overall statistical significance using the

Wilk's multivariate test of significance, (F (32, 54) = 1.19, p = 0.282 derived from Rao's (1973) formula of F test (Hull & Nie, 1981). The overall MANOVA for the EPQ data showed a near significant result (F (8, 88) = 1.95, p = 0.063) using the same criterion (output in Appendix 4). A ONEWAY ANOVA (Nie, Hull, Jenkins, Steinbrenner & Bent, 1975) of the I-E data also showed a near significant result F (2, 46) = 2.99, p = 0.06, although not quite in the direction expected (output in Appendix 4). Non-gamblers and GA members have fairly similar scores with gamblers having the highest scores rather than the scores getting progressively higher from non-gamblers to gamblers to GA members (see Table 1).

Fig. 1. The scores of non-gamblers, social gamblers and GA members on the N scale of the EPQ



The only significant result in the univariate F-tests was that GA members scored significantly higher on the N scale of the EPQ than both the gambler and non-gambler groups as shown in Figure 1.

An analysis of the mean ages of the three groups of subjects did not reveal any significant differences as shown in Table 2.

Table 2. The mean ages of non-gamblers, social gamblers and GA members.

		Non-gamblers	Social Gamblers	GA members
Age	M	37.2	35.6	36.3
	SD	16.2	13.3	11.9

The age data showed that even though there was a difference in the number of subjects in each group, the average ages of the subjects were relatively similar.

Discussion

Overall, the three groups did not differ appreciably on most of the variables investigated, with one measure yielding a significant difference and another a near significant difference. The three groups of GA members, gamblers and non-gamblers scored relatively similarly on the factors of the 16 PF in contrast with Carey's (1968) results which showed that compulsive gamblers can readily be differentiated from non-gamblers using the 16 PF.

This group of GA members was not a representative sample of pathological gamblers. These individuals had taken the initiative to do something about their problem by joining a self-help group, although the motivation to do so might not have been entirely voluntary (Livingston, 1974). Most of the members in this sample had been involved with the GA group, either in its formation or propagation. Thus, the GA group consisted of people who were highly motivated to alleviate their gambling problem. This probably illustrates the bias when a sample is selected from a population receiving therapy especially one which is voluntary and autonomous. However, as long as generalisations are made with caution GA members are the most readily available source of pathological gamblers for study.

As expected, GA members experienced significantly more problems than gamblers. This is hardly surprising given that the amount of involvement in gambling by GA members is considerably greater. The increased difficulties in the lives of GA members may be attributed to the greater frequency in gambling with high stakes. This inevitably resulted in an unpleasant state of endless worry over unpaid

bills, debts and the usual deteriorating marital relationship (Scodel, 1964; Goorney, 1968; Bolen & Boyd, 1968; Boyd & Bolen, 1970; Seager, 1970; Pokorny, 1972; Livingston, 1974). Thus, a high N score on the EPQ by GA members is not too surprising. This result parallels Moran's (1970a) study of the personality variables associated with pathological gamblers interpreted in terms of Eysenck's theoretical framework. The personal and interpersonal problems associated with heavy gambling may be one reason that GA members have consistently been shown to have a high neuroticism score (Blaszczynski, 1982; Seager, 1970). It is interesting to note that social gamblers and non-gamblers had fairly similar group means on the N scale. This major deviation from the rest of the significant results may provide a relevant finding of some importance. The relationship suggests that coping strategies may be at fault rather than personality disorders. It is reasonable to infer that although social gamblers may experience problems due to their gambling activities they seem to cope successfully in the main. Oldman (1974) asserted that the particular mechanism whereby one reaches a crises point is a consequence not of personality defect but of a defective relationship between a strategy of play an the one hand and a way of managing one's finances on the other. Thus, the clinical implications seem to indicate that interventions in the cognitive and behavioural area may prove productive.

An expected feature that gamblers have a higher external score than non-gamblers is not supported by the present data. The research on this aspect of personality has provided ambiguous results and further work will be carried out in this area. However, as Conrad (1979) suggested, differences

in characteristics observed could have arisen from varied methodologies and measuring techniques employed by individual investigators. The diverse samples of gambler groups, and particularly the criterion used for determining the gambler samples, used by different researchers is another possible explanation for the observed discrepancies. Furthermore, this lack of agreement in the measure traits may be due to the observation that even within a group of pathological gamblers there exists subgroups of individuals exhibiting different attributes (Moran, 1970b).

GA members, gamblers and non-gamblers did not appear to be separated on a continuum, at least in terms of the tests used in this study. The results failed to indicate any trend showing that GA members and non-gamblers are always placed at the extremes of the relevant characteristics measured as would be predicted by the disease model of pathological gambling (Gambler's Anonymous, 1974). No clear progression of the severity of the characteristics was observed. This finding casts some doubt on the notion that pathological gambling is a disease. Given the relatively small number of subjects in each group, especially GA members, one may be a little hesitant in disclaiming such a pervasive conception. Another reason for caution is that the tests used are not clinical in nature so clinical interpretions should be guarded. At a speculative level, it has implications not just for treatment practices in pathological gambling but also for alcoholism since, in the main, the paradigm of pathological gambling has been modelled on alcoholism. It may be convenient to comply with the disease conception but the fact that no psychoactive agentis involved in pathological gambling must surely differentiate it from other

forms of addiction. Perhaps, a new paradigm could emerge as a result of the study of psychological addiction which does not include the confounding effects of external psychoactive agents. Gambling and jogging provide excellent examples for such research.

The existence of personality factors associated with pathological gambling could be treated as being either the consequence or the cause of the aberrant behaviour. Nevertheless, it is useful to identify the characteristics that are associated for treatment and heuristic purposes. Much research in this area is required before any firm conclusions can be drawn. The use of varied test instruments, although making comparisons difficult, will provide a convergence of the true nature of the personality of gamblers, provide that strict sampling procedures are followed.

The present findings indicate that non-clinical personality tests such as the 16 PF do not differentiate between groups of `normals' (non-gamblers), non-problematic, social gamblers and pathological gamblers. There was a near significant difference between gamblers and both non-gamblers and GA members in terms of the I-E scores. The only significant difference between the three groups was on the N scale of the EPQ, showing that GA members are greater `worriers' than the other two groups.

CHAPTER THREE

THE RELATIONSHIP OF GENDER, LOCUS OF CONTROL, LUCK, REINFORCEMENT AND GAMBLING.

Introduction

Studies on risk-taking and gambling in the laboratory have mainly concentrated on the stimulus features of gambling including: probabilities, variances, expected and subjective expected values and utilities, and risks of gambles (Edwards, 1953, 1954a, b, c; 1955; Coombs & Pruitt, 1960; Lichtenstein, 1965; Tversky, 1967; Wallach & Wing, 1968; Sjoberg, 1968; Slovic & Lichtenstein, 1968; Slovic, 1969a, b; Lichtenstein et al., 1969; Lindman, 1971; Payne & Braunstein, 1971; Nygren, 1977; Hatano & Inagaki, 1977; Coombs, Donnell & Kirk, 1978; Aschenbrenner, 1978; Montgomery & Adelbratt 1982). Small amounts of money or chips that are later exchanged for money usually constitute the stakes in the gamble. The behavioural indices associated with these experiments frequently involve subjects' assessment of the worth of the given gambles in terms of the choice of pairs or sets of gambles selected. The bidding price for the more attractive gamble or the selling price for the unattractive gambles have also been ways of determining their value.

It is generally agreed that predictive behaviour on any given trial is a function of results of the preceding trials (Jarvik, 1951; Nicks, 1959; Anderson, 1960; Anderson & Whalen, 1960). In the same vein, Myers & Fort (1963) were able to show that choice behaviour is largely a function of expectancies generated by the preceding pattern of events

(responses as well as stimuli). This suggests that the memory of previous circumstances may play an important role in decision-making. In a gambling situation, Gilovich (1983) showed that his subjects, in a recall task three weeks later, were able to remember their `losses' better than their `wins'. The relationship between sequential behaviour and the recall of other parameters of gambling: the amount of money staked and the amount won or lost has yet to be studied. The effect of the outcomes of gambles, such as the hands that were dealt in poker and blackjack, the numbers that turned up on throws of dice, and the like, is another unexplored area. It has been found that the level of arousal has consequences for recall in learning and memory experiments (Walker, 1967; Folkard, 1980; Folkard & Monk, 1980). Such studies have been reviewed in Eysenck (1977) and they generally support the hypothesis that a heightened arousal is detrimental to short term retention. It is considered that this framework may be useful in understanding the nature of the cognitive processes involved in gambling behaviour. Gambling may be conceptualized as a process which produces fluctuations in the basal level of arousal. Events such as the number of wins and losses encountered and the degree of uncertainty in the situation may bring about a change in the level of arousal which alters the perception and attribution of previous events.

A number of other factors have been studied in relation to gambling behaviour. The results of sex differences and locus of control research in a gambling context have generally proved inconclusive. The notion of luck was thoroughly analysed by Cohen and his associates in the late sixties but their investigations did not extend to the role

which luck plays in gambling. This would be a logical progression from Cohen's research in light of the frequent associations of luck to gamblers and gambling behaviour. The rest of this section will involve a review of the major studies of these factors in a gambling context.

Sex differences

Studies of sex differences in choice behaviour have generally concentrated on the preference for skill or chance activities by males and females (Schneider, 1968; Deaux, White & Farris, 1975; Karabenick & Eddy, 1979; Karabenick, Sweeney, & Penrose, 1983). Schneider (1968) showed that males who scored as more external on 'a forced-choice revision of the internal-external locus of control scale' tended to prefer chance activities on the masculine and neutral skill activities when provided with previously categorised masculine, feminine and neutral chance/skill activities. For females, this relationship held only for the neutral and feminine activities. In both field and laboratory studies, Deaux et al., (1975) found that males compared to females, showed a preference for games requiring skill and persisted longer at these games, while females preferred to select games in which the outcomes were largely determined by luck.

Karabenick & Eddy (1979) concluded that, in general, females are more conservative and males more risky under chance conditions. Pursuing the same line of research, Karabenick et al., (1983) clarified the original findings. Men's skill preferences were higher than women's on a masculine task and women preferred skill more than did men on a feminine task. Furthermore, skill versus chance

preferences were likely to vary with changing conditions, thus it cannot be concluded that the differential preferences represent generalisable gender characteristics. It was proposed that skill-chance preferences were primarily a function of the expectation of success on skill tasks, that is, skill tasks were more likely to be selected when expectations of success were high and when failure is expected, chance tasks were preferred.

Research on sex differences in risk-taking is sparse. Kass (1964), in a study of decision-making behaviour in children aged 6, 8 and 10, found that boys chose the low and intermediate probabilities of payoff significantly more than girls. A similar result was obtained by Slovic (1966) with children aged 6 to 16, that is, boys were bolder than girls. However, Kopfstein (1973) failed to replicate Slovic's result with his 9-year-old subjects and Jamieson (1969) did not find any significant sex differences on risk-taking behaviour in his 10 to 12-year-olds.

In the adult population, males in sexually homogeneous groups took more risks than females (Wallach, Kogan & Bem, 1964; Bauer & Turner, 1969; Guttentag & Freed, 1971) whereas no differences between the sexes were reported in other studies using similar samples (Wallach, Kogan & Bem, 1962; Pruitt & Teger, 1969). At present, the results of available psychological research on sex differences in risk-taking remain equivocal.

Sociological surveys by Downes et al., (1976) on a cross-section of British society indicated a number of interesting sex differences. For example, in terms of regular participation, in comparison with women, twice the number of men bet on football pools, eight and a half times

the number of men go to betting shops, men are 23 times more likely to bet privately, and about 16 times more men than women take part in pub games. On the other hand, in bingo, women and men participate equally, although it is commonly thought that bingo sessions are frequented mainly by females. Three times as many women indulge in casino gaming than men but with generally lower stakes than men. Moreover, on the other side of the Atlantic, Herman noted that slot machine gamblers are disproportionally made up of persons who are poor, women, older, and small stake bettors. Shapiro (1982) also observed that there are more women playing slot machines than men but the relationship is reversed for the game of craps. Thus, it is clear that differences in gender preference in gambling activities exist. However, it must be remembered that the data were obtained from a survey and any causal inferences should be made with caution. Plausible sociological explanations have been suggested to account for the findings, including; the role of educational attainment, pursuit of hobbies, social class, work experience and the like (Downes et al., 1976).

It may also be interpreted that the amount of participation in the various forms of gambling is differentiated along sex roles in the traditional family. The relatively higher number of females indulging in `cheaper' gambling activities such as betting on football pools or bingo may reflect an aspect of the familial system, that is, the man as the income earner and the woman as the house-keeper. Not controlling the income decreases the access to money, its distribution and expenditure, resulting in limited funds and possibly less choice in gambling activities. The gap in the occupational status and wealth

between the sexes has narrowed considerably in recent years and could very well alter the gambling patterns.

In general, studies have indicated that males tend to take greater risks than females. Males also appear to prefer skill tasks and females prefer chance tasks. A number of variables seem to be influential in the choice of tasks including; gender appropriateness of the tasks, expectations of success and failure, social class, educational attainment and motivation (Atkinson, 1957; Littig, 1963) of the participants. These factors should be noted in the design and interpretation of risk-taking and gambling experiments.

Luck

The use of the concept of luck in the literature often refers to a chance situation on a skill-chance continuum. This is an interesting notion of luck which will be discussed in a later section along with a review of the generalised expectancy for the internal and external control of reinforcement construct. The primary aim of this section is to examine the extent to which personal characteristics may be associated with a conception of luck embodying divine properties. The notion of luck or fate customarily accompanies discussions on gamblers and gambling. Psychoanalysts are no exception. Bergler (1958) affirmed that,

> The gambler is apparently the last optimist; he is a creature totally unmoved by experience.... There is nothing more tragic than the gambler who has lost his last dollar and is still convinced that he will 'surely' win a fortune, if only he can get hold of the money to tide him through this temporary run of bad luck. Every

gambler gives the impression of a man who has signed a contract with fate, stipulating that persistence must be rewarded.

Bergler (1958) himself seemed to accept that luck is not merely a belief, stating that, "Without luck, success, is impossible. But luck alone is not enough. Only the combination of luck-plus-personal initiative spells success." Bergler further asserted that the man who is a failure will lay heavy stress on the element of luck when he is forced to concede a competitor's success. As an anonymous writer put it, "Good luck is the lazy man's estimate of a worker's success." (cited in Bergler, 1958).

In his analyses of gambling, Greenson (1947) noted that neurotic gambling has two crucial components: (1) The neurotic gambler feels happy and hopes each time he will be rewarded, despite all intellectualisation to the contrary and, (2) The neurotic gambler is impelled to test his luck or fate. Consciously or unconsciously, he believes in his right to ask fate for special privileges, he mistakes his strong yearnings for omnipotence for the feeling that he is, in fact omnipotent. Greenson added that luck and fate are derived from mother and/or father images.

Veblen (1899) asserted that,

> The chief factor in the gambling habit is the belief in luck; and this belief is apparently traceable, at least in its elements, to a stage in human evolution antedating the predatory culture.... In its simplest form the belief in luck is the instinctive sense of an inscrutable telelogical propensity in objects or situations.

Cohen (1960) also acknowledged that the concept of luck is more basic or `primitive' than the practice of gambling.

He went on to suggest that,

> all our decisions and predictions are guided or governed, implicitly if not explicitly, by what we imagine luck or unluck might bring and not merely on cold-blooded calculations... what we imagine might happen if we were lucky or unlucky would shape our belief in the outcome that would occur if we were neither particularly lucky nor particularly unlucky. Furthermore, realistic and unrealistic expectations could coexist in mutual interaction.

In a series of empirical studies on luck, Cohen and his associates uncovered some illuminating results. According to Cohen & Christensen (1970), our reliance on luck seems to vary inversely with the level of our performance, achievement or good fortune. As things get worse we are apt to `coerce' them to improve, by a reliance on luck or by an omnipotence of wish. In earlier experiments, Cohen (1960) showed that our expectation of success is determined firstly by the difficulty of the task. The luck aspect plays only a secondary role: when the task seems very easy we believe we shall nearly always succeed, however unlucky we are. In contrast, when the task seems extraordinarily difficult we think we shall always fail however fortunate we might be. At intermediate degrees of subjective difficulty, we tend more toward the point of maximum uncertainty of success, and our lucky or unlucky estimates then depart more and more from realistic ones. When the lucky or unlucky estimates for difficult tasks are similar, the corresponding realistic estimates will also be similar. However, luck or unluck are not thought of as affecting performance symmetrically about a realistic average. The decrement expected to occur as a

result of unluck is three times as great as the increment luck is expected to bring; the discrepancy is nearly as great between the increment due to `very lucky' and the decrement due to `very unlucky'.

There also seems to be a sex difference in the belief in luck. In a survey of 200 Training College students and Grammar School boys aged about 15, more women students felt lucky than their male counterparts in a chance task, for 12 percent of females compared with 7 percent of the males believed that they would draw the winning ticket (Cohen, 1960).

In a recent study, Teigen (1983d) demonstrated that economic factors like cost, profit and loss, are central for the assessment of good and bad luck. Contrary to expectation, the probability of success did not appear to be of any importance whatsoever. Teigen suggested that luck may not be related to degrees of probability at all, but to amount of chance, that is, to the degree the individual himself is unable to control or predict the `lucky' or the `unlucky' outcomes.

The idea of luck is ubiquitous but is by no means simple, in that it means different things to different people (Cohen, 1960). Luck also seems to assert varying influences under a variety of circumstances. The belief in luck and its potency is most prevalent under chance conditions and other situations of uncertainty. This may help explain why luck is so commonly accepted as an integral part of gambling in the literature.

Locus of control

When a reinforcement is percieved by the subject as

> following some action of his own but not entirely contingent upon his actions, then, in our (Western) culture it is typically perceived as a result of luck, chance, fate, as under the control of powerful others, or as unpredictable because of the great complexity of forces surrounding him. When the event is interpreted in this way by an individual, we labelled this a belief in external control. If a person perceives that the event is contingent upon his behaviour or his relatively permanent characteristics, we have termed this a belief in internal control.
>
> Rotter (1966).

For the sake of brevity the former will be referred to as external and the latter as internal but it should be noted that the control refers to that of the expectancy of reinforcement as effected by the individual's behaviour.

Following Rotter (1966), research into the construct of a locus of control of generalised expectancy of reinforcement has been extensive. Hence, the present discussion will be limited to the relationship of the construct with information utilisation, choice and preference in skill/chance tasks, and risk-taking. In an early study, Phares (1957) found that the expectancy of control influences the way individuals behave. Changes in the numbers of poker chips wagered were significantly greater when subjects received skill than when they received chance instructions. There was more shifting of expectancies among skill-instructed subjects, but chance-instructed subjects tended to make more `unusual shifts', that is, subjects given chance directions responded as if each success reduced a finite supply of luck and after failure the likelihood of success increased. James & Rotter

(1958) confirmed Phare's findings that perception of control predicted the manner in which people would respond to their performance outcomes.

In terms of the relationship between locus of control and the desire for information, Seeman & Evans (1962) showed that internals avail themselves of information, even if it has negative consequences for themselves, more than do externals. It has been assumed that internals believe that they can act on their own behalf and therefore require more information, while externals more readily accept dependency on more competent others and thus have less need for information. In another study, Phares (1968) compared internals and externals in their use of information for decision-making. He concluded that internals make better use of information than externals in spite of the fact that both might have equivalent funds of information. Williams & Stack (1972) and DuCette & Wolk (1973) have found evidence that internals are quicker at extracting cues that will facilitate the making of accurate judgements than are externals. They were also able to show that the former are capable of better recall of performances and are more likely to make better use of information for drawing estimates of their subsequent performances than are the latter.

To summarise, most research supports the assumed relationship between locus of control and cognitive activity. Whether the focus has been on attention, deliberation, inquisitiveness or utilisation of information, internals have more often been found to be active and alert individuals than are externals.

There have been a number of studies investigating the relationship between risk-taking behaviour and locus of

control but only a few have emphasised economic or actual gambling in relation to the construct. For example, high and low scorers in locus of control did not yield significant differences in an ethical risk-taking task (Krauss & Blanchard, 1970). With risk-taking under novel conditions (Newman, 1977) and using Kogan and Wallach problems (Baron, 1968), results indicated that externals were more conservative in the former study and more daring in the latter study. Using a board-game (Jeopardy) and a card-game where the outcomes were perceived to depend on skill and chance respectively, Lupfer & Jones (1971) found that decisions made under a skill orientation were marked by a higher mean level of risk and a less variable pattern of risk than decisions made under a chance situation.

Liverant & Scodel (1960) proposed that internally controlled persons were conceptualised as persons who attempt to maintain control in chance-dominated situations by a cautious and planned selection of probabilities, whereas externally controlled persons decide according to `hunches' or previous outcomes. In a dice gambling game the main difference between internals and externals was that internals chose significantly more intermediate and fewer low probability bets than externals. Significantly more internals than externals never selected an extreme high or low probability bet, the amount of money wagered on safe as against risky bets was significantly greater for internals, and there was a tendency for internals to be less variable in the choice of alternatives. In other words, in a chance situation internals are more conservative.

Several studies have indicated that people are willing to take greater risks when they feel that they have control

over the outcomes of their decisions (skill orientation) than when they feel that the outcomes of their decisions are due to forces beyond their control (chance orientation). Cohen (1960) provided illustrations of a variety of contexts in which subjects preferred risk-taking situations where the possibility of control existed. Littig (1962), using a pinball machine, and Strickland et al., (1966) using dice, also obtained results which suggested that a skill orientation may lead to greater risk-taking than a chance orientation. However, in an analysis of subjects' economic decisions, Higbee & Streufert (1969) noted that those subjects who perceived that conditions in the simulated environment were due to their decisions tended to take fewer risks than subjects who perceived that conditions were due to forces beyond their control.

In summary, in risk-taking research, the results appear inconclusive as to whether internals or externals take more risks. The situation is further confounded by the observation that both internals and externals respond differently to skill or chance activities (Rotter & Mulry, 1965; James, 1957 cited in Lefcourt, 1976; Julian & Katz, 1968; Leftcourt, Lewis & Silverman, 1968; Lefcourt & Telegdi, 1971). In general, it is accepted that under chance conditions externals are more daring and under skill conditions internals take more risks. The finding that internals become more conservative under chance conditions while at the same time externals taking slightly greater risks under chance compared to skill conditions may tend to exaggerate the difference in the risk-taking propensity between internals and externals.

Rationale for the use of locus of control scales.

Most of the scales in the assessment of the locus of control (examples, James' I-E Scale, Rotter's I-E Scale, Nowicki-Strickland Locus of Control Scale, and others- see Lefcourt, 1976) are intended as a very broad measure of generalised expectancies. As such, Rotter (1975) suggested that the I-E scales allow for more accurate behavioural predictions in psychological situations which are novel and/or ambiguous for the individual. Monetary risk-taking behaviour as a dependent variable is used to assess the relationship of a particular construct of uncertainty and that of locus of control.

Research on recall in relation to risk-taking and locus of control is sparse and the influence of memory in risk-taking has so far been neglected. It is proposed that information concerning the financial situation and luck status of individuals during a gambling session is likely to bias betting and perhaps recall behaviour as well. This is especially pertinent in sequential gambling which is probably more typical of gambling outside the laboratory.

A survey of the literature reveals a great number of inconsistencies and unanswered questions. There are many variables that seem to be important in influencing gambling behaviour. An attempt was made in this experiment to determine the relationship between gender, locus of control, effects of luck information and recall of certain aspects of the gambling event, as well as the risk attached to such gambles. It was hypothesised that:

1. In line with previous research and social expectation males will take more risks than females.
2. In a predominantly chance-determined gambling task

externals will take more risks than internals.

3. Subjects will take more risks under a favourable schedule of reinforcement than under an unfavourable schedule.

4. When informed of their luck subjects will take more risks when told to expect good luck and fewer when bad luck is forecast. Under ordinary luck condition (what is expected on a usual day) no change in risk-taking behaviour will be expected whether the subjects are informed or not (These two hypotheses were formulated on the assumption that subjects try to maximise their wins).

5. No difference in recall is predicted between males and females.

6. Internals are predicted to have better recall than externals since they have been shown to be more attentive and to utilise information more efficiently.

7. Recall of gambling events will be better under poor reinforcement conditions. Gilovich (1983) showed that subjects remembered losses better, at least in the long term, and made the assumption that aversive events (losses) were more salient and thus better retained in memory.

8. Information on luck will increase the saliency of the outcome which should promote greater retention of the events occurring in the gambling session resulting in more accurate recall.

Method

Subjects

The Rotter's I-E Scale was administered to 56 psychology undergraduates during laboratory sessions as a survey on the attitudes of students. The students were informed, on completion of the questionnaire, that they might be approached later to participate in a gambling experiment.

After scoring the questionnaires, subjects who scored high were put into one group and subjects who scored low into another group. Within each group 7 males and 7 females were matched as closely as possible on the I-E scores. To sharpen the differentiation between the high scorers and the low scorers, only the 28 students who scored in the extremes were included. Although there was an overall tendency for the male students to score lower than female students on the I-E scale it was possible to obtain two sexually homogeneous groups in terms of I-E scores. The mean age for the whole sample of 28 was 19.7, ranging from 18 to 23 years. The mean I-E score for the 7 low females (LF) was 8.6 and 15.7 for the high females (HF). The mean score for the 7 low males (LM) was 8.4 and 15.1 for the 7 high males (HM).

Experimental manipulations

Four independent variables were introduced in the experiment: (1) gender of the subjects, (2) locus of control, (3) fortune - neutral, good and bad and, (4) availability of information - informed of ordinary, good and bad luck, and not informed.

Subjects were grouped into high or low locus of control and gender with equal numbers in each cell. They were then

presented with 7 blocks of 15 gambling trials each. The number of reinforcements or payoffs resulting from the bets was varied systematically on the 7 blocks of trials (see Appendix 5). These schedules of reinforcements will be referred to, from here on, as the fortune conditions. On 'neutral' fortune conditions subjects received 8 payoffs, 11 payoffs on good fortune conditions and 6 payoffs characterised the bad fortune conditions.

On the first 3 blocks of trials subjects were not told anything but on the next 4 blocks of trials subjects were instructed that they may experience ordinary, bad, good, and bad luck respectively. Table 3 depicts a summary of the experimental manipulations.

Table 3. Summary of the experimental manipulations of the payoffs and the luck information presented.

Blocks of 15 trials	Number of payoffs in each block	Luck information
1	8	
2	11	› not informed
3	6	
4	8	
5	8 (REJECTED)	
6	11	› informed
7	6	

Condition 5 is the condition in which subjects were informed that they may experience bad luck when in actual fact they were given reinforcements which constituted an ordinary luck condition. Although condition 5 was presented to every subject it was excluded from all analyses since it

was felt later that one misinformed condition was inadequate for making valid statistical comparisons. The inclusion of condition 5 also preserved the order of presentation of the conditions such that the 7 subjects in each of the 4 sex by locus of control cells were randomly assigned to start the experiment in one of the 7 different payoff blocks.

To reiterate, fortune refers to the reinforcement or payoffs received and luck is only relevant when subjects were informed, that is, conditions 4, 6 and 7.

Procedure

Subjects took part in the experiment in a room 2m by 3m in size. The first experimenter, seated on the the same side of the screen as the subject, provided him/her with all of the instructions and presented the stimulus information for the gambles.

Subjects were informed that they would be given $2 to gamble in a dice game and that they could keep the balance at the end of the game. They were asked to treat the situation as they would if they were actually gambling. Subjects were also told that a choice of two numbers ranging from 1 to 6 would be called out from which they have to choose one. For each trial the subjects were required to choose a bet from a given pair with a constant 4-cent difference (Appendix 6).

Subjects were instructed to recall the following information after every block of 15 trials:

1. The amount they staked- giving the total of the first, second, and third group of 5 trials (Appendix 7),
2. The amount of money they won or lost for the whole 15 trials totalled up (Appendix 8),
3. Their choice of numbers on each trial and,

4. The number of times each die number turned up.

A set of 3 dice were shaken and `thrown' for each trial. The rolls of the dice were predetermined and were randomly generated by a TRS-80 micro-processor. All subjects were given the same set of 3 numbers except when they were supposed to strike a `win', in which case the second experimenter, behind the screen, would arrange the die or dice (since the subject could have one or more wins on each trial), to show the numbers that were supposedly thrown (Appendix 5 and 6). The throwing of the dice was simulated by shaking and throwing a second set of dice behind the screen. The pace of the experiment was such that the second experimenter could arrange and present the dice without the subjects suspecting that the dice were being manipulated. Three dice were then shown to the subjects for approximately 3 seconds and a `win' or `loss' would be called out by the experimenter organising the dice. Before 4 of the 7 blocks of 15 trials subjects were given additional information - that they may experience some patches of good, bad or ordinary luck - according to the experimental information conditions. For the other blocks of trials the subjects were simply told nothing. At the conclusion of the gambling trials subjects were verbally presented with 6 questions regarding certain features of the gambling session (Appendix 9).

Results

The results were analysed by a 2 (locus of control - low, high) x 2 (sex - male, female) x 3 (fortune - neutral, good, bad) x 2 (information - informed : ordinary, good, bad and not informed) analysis of variance for repeated measures.

Risk-taking

In this experiment risk was defined as the number of higher bets chosen out of the two given bets in each trial. In analyses of the risk-taking measure the most prominent effect resulted from the fortune manipulation. A summary of the group means of the higher stakes chosen or risk-taking is given in Tables 4 and the ANOVA summary table is available in Appendix 10.

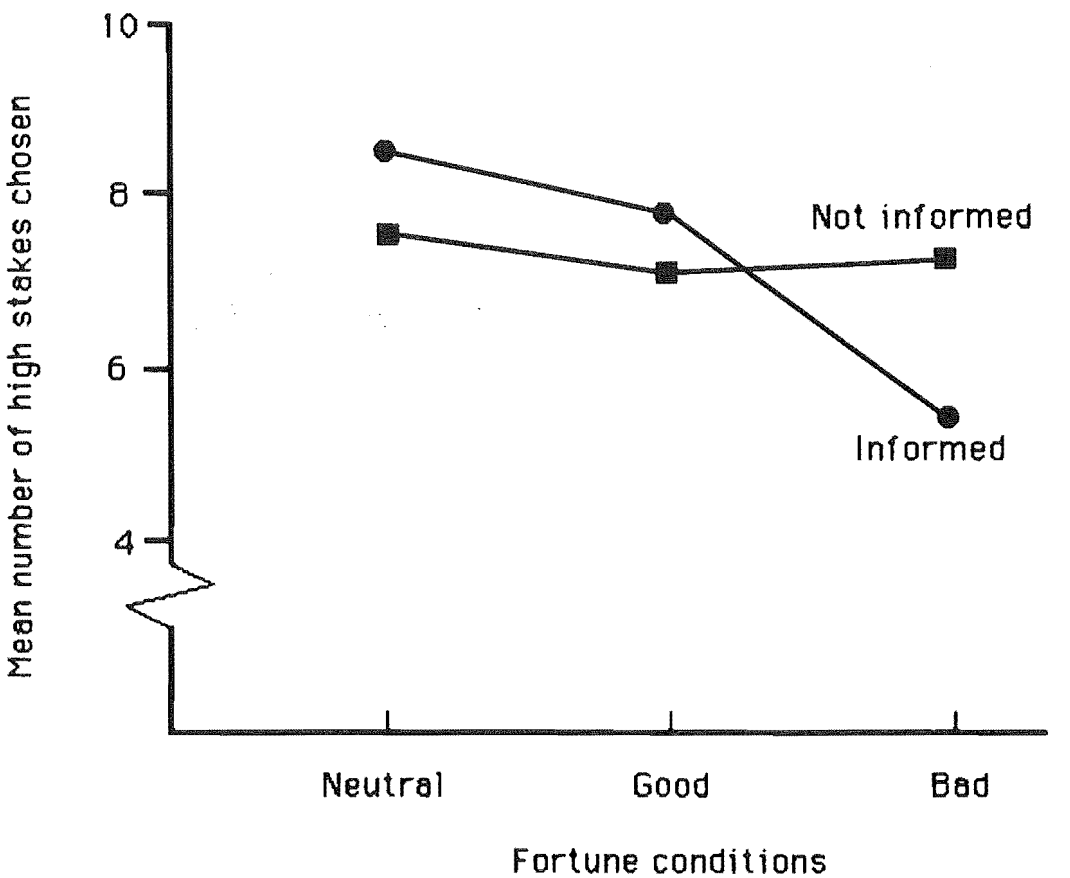
Table 4. Group means of the higher stakes chosen by subjects under the various experimental conditions.

Locus of control		High	High	Low	Low
Sex		Females	Males	Females	Males
Information	Fortune				
Yes	Neutral	6.14	8.00	7.57	8.71
Yes	Good	5.43	6.57	6.86	9.71
Yes	Bad	5.71	8.14	7.00	8.42
No	Neutral	6.86	7.86	8.71	10.43
No	Good	5.43	7.43	9.14	9.29
No	Bad	5.43	6.00	4.14	5.43

The highest amount of risk was taken under conditions of both neutral and good fortunes compared to significantly more conservative betting made under bad fortune $F(2, 48) = 10.5$,

$p = 0.0002$. The situation is further clarified by the significant interaction of fortune by information $F(2, 48) = 5.9$, $p = 0.005$, as shown in Figure 2.

Fig. 2. The amount of risk taken under the neutral, good and bad payoff conditions when subjects were informed that they may experience ordinary, good or bad luck, or when not informed about their luck.



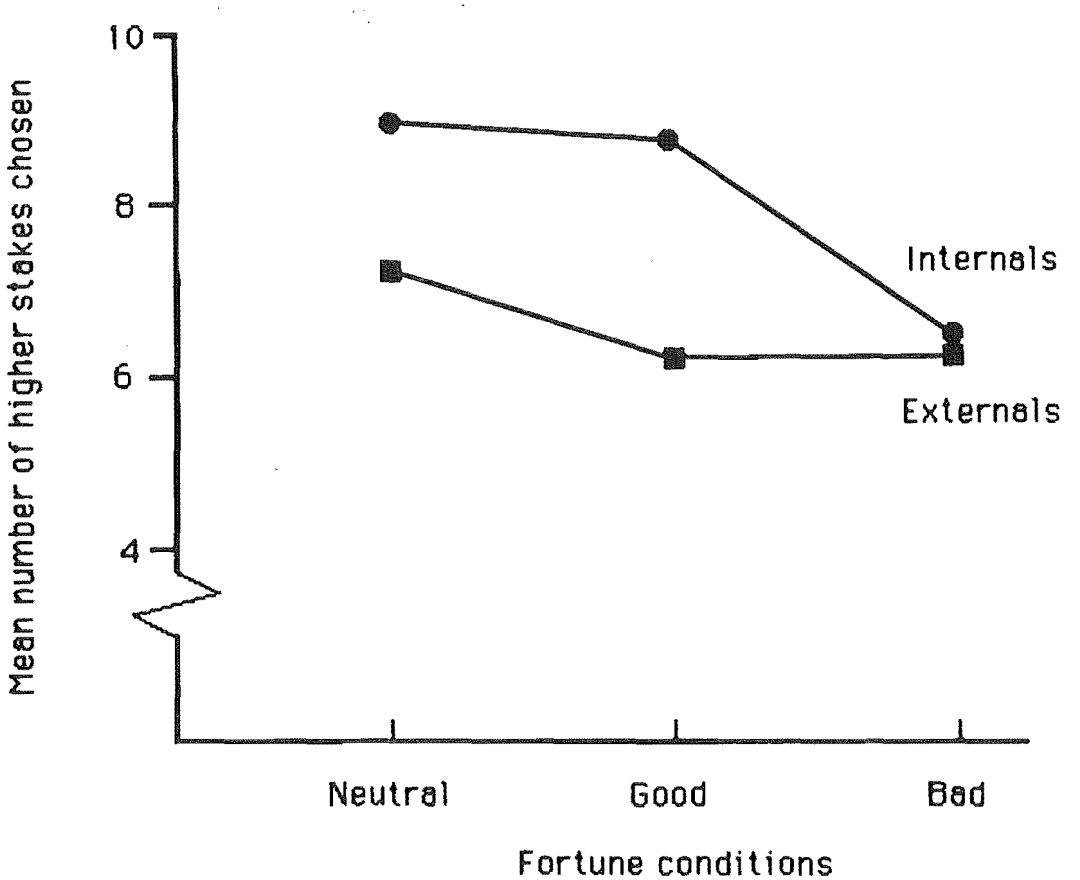
The graphs show that when subjects were not informed, an equivalent amount of risk was taken in all three fortune conditions. However, when informed that they were going to experience different luck circumstances subjects increased the number of high bets when told they might experience good luck and decreased the number of high bets when told they might experience bad luck.

There was a trend for males (mean = 8.1) to choose

higher stakes than females (mean = 6.3) but the difference is not significant. In terms of the overall success for the whole gambling session none of the four criterion groups performed any better than the others. The overall mean balance at the end of the sessions was $1.72 and the means associated with the groups were: HM = $1.70, LM = $1.79, HF = $1.64, LF = $1.73.

The only locus of control manipulation that produced a significant effect in the experiment is in the fortune by locus interaction (Figure 3).

Fig. 3. The amount of risk taken under the neutral, good and bad payoff conditions by internals and externals.



Externals, on the whole, were unaffected by the different fortunes they were encountering as shown by the fairly uniform willingness to take risks under the varying reinforcement schedules. In contrast, internals varied their

risk-taking according to the differential fortunes, taking more risks under neutral and good fortune and exhibiting restraint under bad fortune conditions.

Recall

Several analyses of variance for repeated measures were performed to assess the effects of the experimental manipulations on recall. A number of indices were available and it was decided that the following would be most relevant. These included the stimulus and response aspects of gambling, that is, input into and outcomes of gambling. In the context of this experiment these translate into the recall, for each block of 15 trials, of:

1. The numbers chosen by the subjects,
2. The most and least frequently occurring number,
3. Estimation accuracy of the amount of money staked and,
4. The estimation accuracy of the amount of money won or lost during the gambling session.

1. The numbers chosen by subjects to place their bets on.

In this ANOVA the data for the winning and losing trials are separated to test for any effect of wins and losses on the recall accuracy. The group means are presented in Table 5 below and the results of the ANOVA are available in Appendix 11.

Table 5. Group means of the accuracy of recall of the numbers chosen by subjects to place their bets on (in percentages).

Locus of control Females			High Female	High Male	Low Female	Low Male
W	I	F				
1	1	1	54.1	62.0	58.9	63.6
1	1	2	59.1	38.9	57.0	42.8
1	1	3	54.3	47.1	48.6	61.4
1	2	1	59.3	50.3	57.3	53.8
1	2	2	45.9	59.1	61.1	65.3
1	2	3	62.9	57.1	63.9	64.3
2	1	1	76.1	71.4	64.3	52.4
2	1	2	50.3	60.8	52.1	55.7
2	1	3	65.7	65.7	71.4	57.1
2	2	1	46.8	59.3	43.0	49.1
2	2	2	46.6	50.3	62.6	46.6
2	2	3	62.9	54.3	65.7	62.9

W - (1 = winning trials, 2 = losing trials)

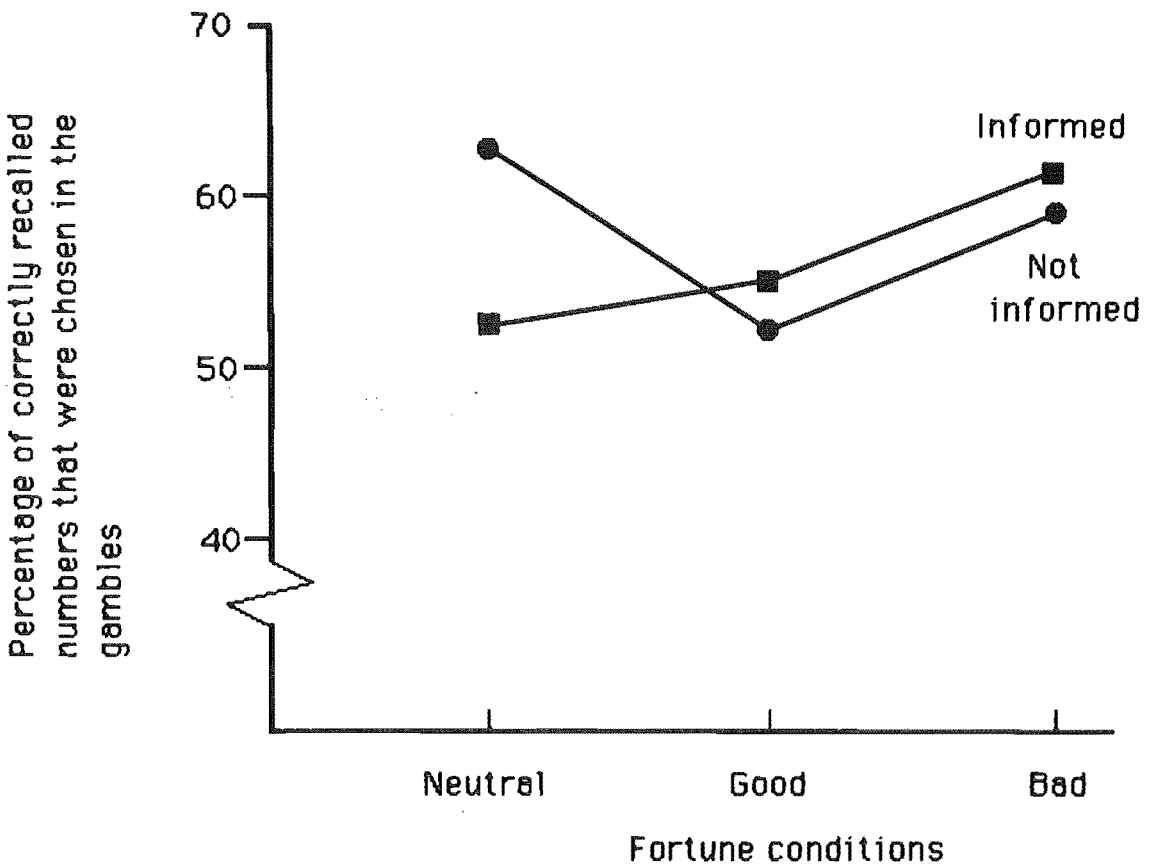
I - (1 = informed of luck status, 2 = not informed of luck status)

F - (1 = neutral fortune, 2 = good fortune, 3 = bad fortune)

The fortune main effect was statistically significant $F(2, 48) = 4.6$, $p = 0.02$ (The percentage of correct recall were, neutral = 57%, good = 53%, and bad = 60%). Subjects were able to recall more accurately the numbers they had chosen when experiencing bad payoffs and recall for the numbers was worst when encountering favourable payoffs. The percentage of numbers correctly recalled was in between these

two extremes under conditions of neutral reinforcement. There was, however, a significant fortune by information interaction F(2, 48) = 5.19, p = 0.01, shown in Figure 4.

Fig. 4. The recall of the numbers chosen when subjects were informed that they may experience ordinary, good or bad luck, or when not informed about their luck.



Whether subjects were told that they would experience good or bad luck did not seem to affect their recall accuracy. Instead, a significant result stemmed mainly from the normal luck condition. Simply being told that they might experience ordinary luck decreased the recall accuracy.

2. The most and least frequently occurring number.

The next analysis looked at the accuracy of the recall of the number that appeared most frequently. Group means of the data are presented below in Table 6 with the ANOVA

summary in Appendix 12.

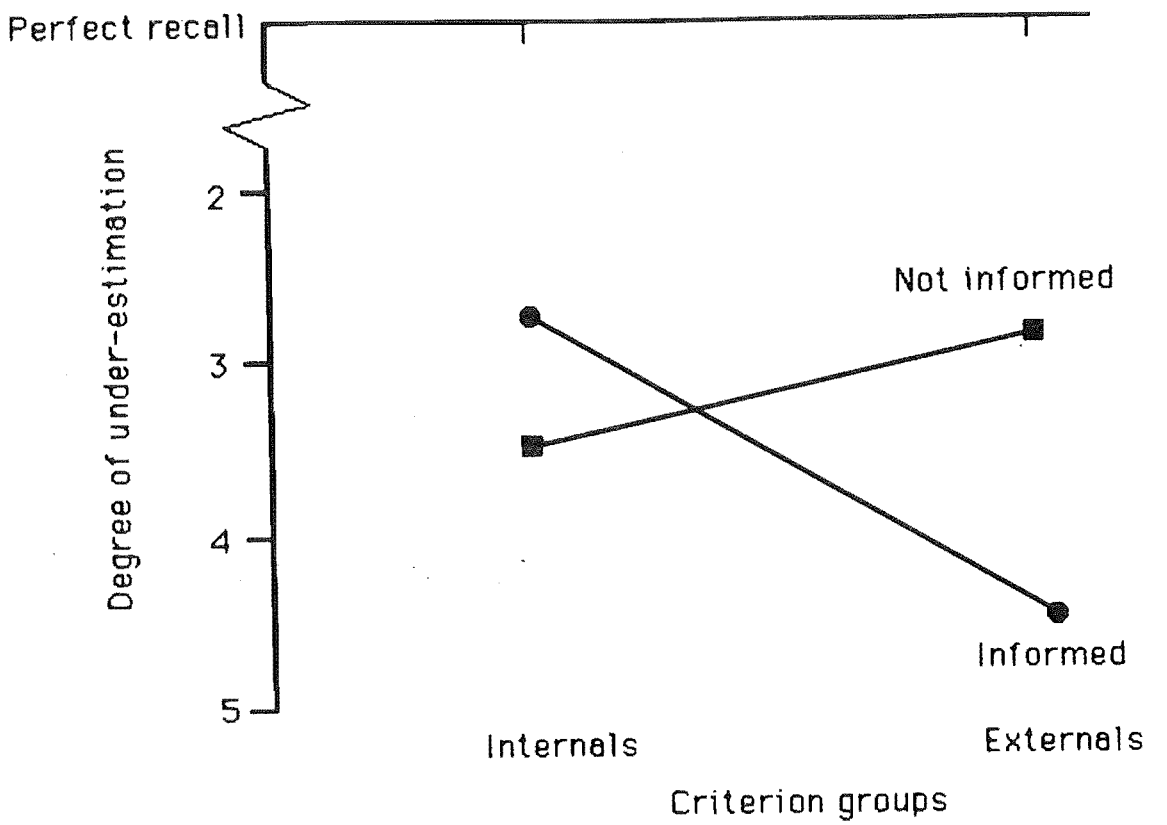
Table 6. The mean recall accuracy* of the most frequently occurring number.

Locus of control		High	High	Low	Low
Sex		Female	Male	Female	Male
Information	Fortune				
Yes	Neutral	-0.7	-3.0	-4.0	-2.6
Yes	Good	-1.6	-3.4	-4.6	-2.4
Yes	Bad	-3.6	-4.3	-3.3	-3.9
No	Neutral	-4.1	-3.9	-2.7	-3.9
No	Good	-4.7	-6.1	-3.6	-2.4
No	Bad	-2.9	-5.6	-3.5	-1.6

*The mean recall accuracy was obtained from the mean occasions of actual appearances of each individual number of the dice thrown subtracted from the mean estimated occasions of the dice numbers that turned up. A negative number indicates under-estimation. (A number of FORTRAN programs were required to transformed the data before they could be analysed by the BMD statistical package.)

It is interesting to note that subjects under-estimated the number of times the most frequently occurring number appeared in all the different conditions. The results with the recall data of the number which appeared most frequently showed that a significant difference in the interaction of information by locus of control $F(1, 24) = 8.6$, $p = 0.007$. The interaction is depicted in Figure 5.

Fig. 5. Recall of the most frequently occurring number in the gambles by internals and externals when informed of ordinary, good or bad luck and when they were not informed of their luck.



The interaction shows that high I-E scorers significantly under-estimated the number of the die that turned up most frequently when they were informed but performed equally well when they were not informed of any possible variation of luck. None of the other manipulations produced any significant effects.

The next analysis involved the recall of the least frequently occurring number. Table 7 below gives the means of the 4 criterion groups in the different conditions and an ANOVA summary table is included in Appendix 13.

Table 7. The mean recall accuracy of the least frequently occurring number.

Locus of control		High	High	Low	Low
Sex		Female	Male	Female	Male
Information	Fortune				
Yes	Neutral	1.7	1.4	3.6	4.6
Yes	Good	3.3	2.7	4.7	3.9
Yes	Bad	3.2	1.9	3.6	4.1
No	Neutral	0.5	2.1	4.0	3.4
No	Good	2.3	4.4	4.1	3.7
No	Bad	3.5	3.9	3.1	4.0

All the values in the table are positive which means that, as opposed to the previous table, subjects, when required to recall the least frequently occurring number, over-estimated in every condition. A significant locus main effect was present $F(1, 23) = 9.5$, $p = 0.005$. Internals (mean = 3.9) recalled the least occurring number significantly better than externals (mean = 2.6).

3. The accuracy of estimation of the amount of money staked.

The following two analyses deal with the recall of means of gambling. The first analysis looks at the estimation accuracy of the amount of money staked. The means of the groups are presented in Table 8 and the associated ANOVA summary table is available in Appendix 14.

Table 8. The mean estimation accuracy of the amount of money staked.*

Locus of control		High	High	Low	Low
Sex		Female	Male	Female	Male
Information	Fortune				
Yes	Neutral	25.6	13.2	-7.0	-1.5
Yes	Good	20.7	7.8	0.7	-5.5
Yes	Bad	33.3	17.4	23.7	8.0
No	Neutral	31.0	16.4	-2.8	5.2
No	Good	25.0	6.0	9.0	9.7
No	Bad	28.0	7.2	28.5	1.7

*The values in the table are derived from subtracting the mean estimated from the mean actual amount of money staked. Positive values, in this case, denote under-estimation and negative values represent over-estimation.

**Due to faulty entry of the information by 8 subjects: 4HF, 2HM, 1LM and 1HM, the results from this analysis should be treated with caution.

The analysis of variance shows that internals (mean = 5.8) were significantly more accurate than externals (mean = 19.3) in estimating the amount of money staked $F(1, 24) = 4.7$, $p = 0.04$.

4. The estimation accuracy the amount of money won/lost during the gambling session.

The final analysis on the recall data is on the accuracy in estimating the amount of money won/lost during the gambling session. The group means of the estimation accuracy are shown in Table 9 and the corresponding ANOVA summary can be found in Appendix 15.

Table 9. The accuracy of subjects' estimation of the amount of money won/lost during the gambling session.

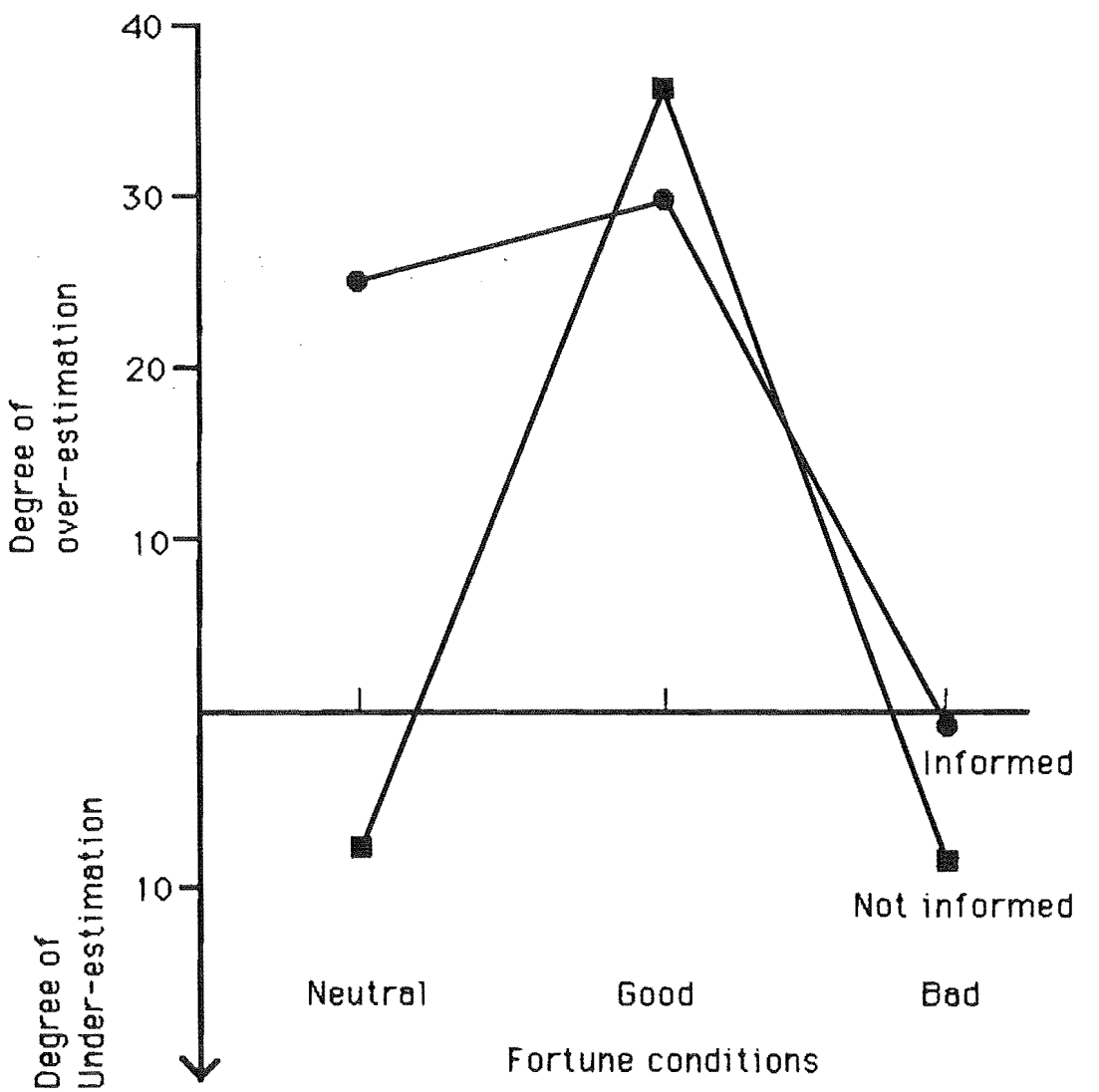
Locus of control		High	High	Low	Low
Sex		Female	Male	Female	Male
Information	Fortune				
Yes	Neutral	-12.6	36.6	12.7	-5.6
Yes	Good	-57.6	-26.1	-34.7	-26.3
Yes	Bad	9.3	25.9	5.0	-5.3
No	Neutral	-23.0	-18.1	-21.7	-32.1
No	Good	-50.0	-22.0	-17.9	-31.0
No	Bad	-9.6	17.7	-7.4	5.1

The figures in the table represent the subjects' mean estimate subtracted from the actual amount of money won/lost. A positive value denotes an under-estimation and a negative value denotes an over-estimation.

Several significant effects were detected in the ANOVA of the above data. The fortune main effect shows that subjects, when given favourable payoffs, largely over-estimated their performance in terms of their wins and losses $F(2, 48) = 17.9$, $p = 0.0001$. Subjects in the neutral and bad fortune conditions were relatively accurate in estimating the outcomes of their gambling. The other significant main effect resulting from the ANOVA was information $F(1, 24) = 5.5$, $p = 0.03$. Subjects informed of their luck tended to be less accurate, displaying greater over-estimation, while they only slightly over-estimated when not informed. There is also a significant fortune by information interaction $F(2, 48) = 5.2$, $p = 0.009$. The interaction shows that information of luck status did not

affect the subjects' estimation when they were encountering a poor payoff schedule but influenced the subjects towards over-estimation under neutral and favourable payoff schedules (Figure 6).

Fig. 6. Accuracy of subjects' estimation : The mean of subjects' actual wins/losses subtracted by their estimated wins/losses recorded after each block of 15 gambles when they were informed of ordinary, good or bad luck and when not informed of their luck.

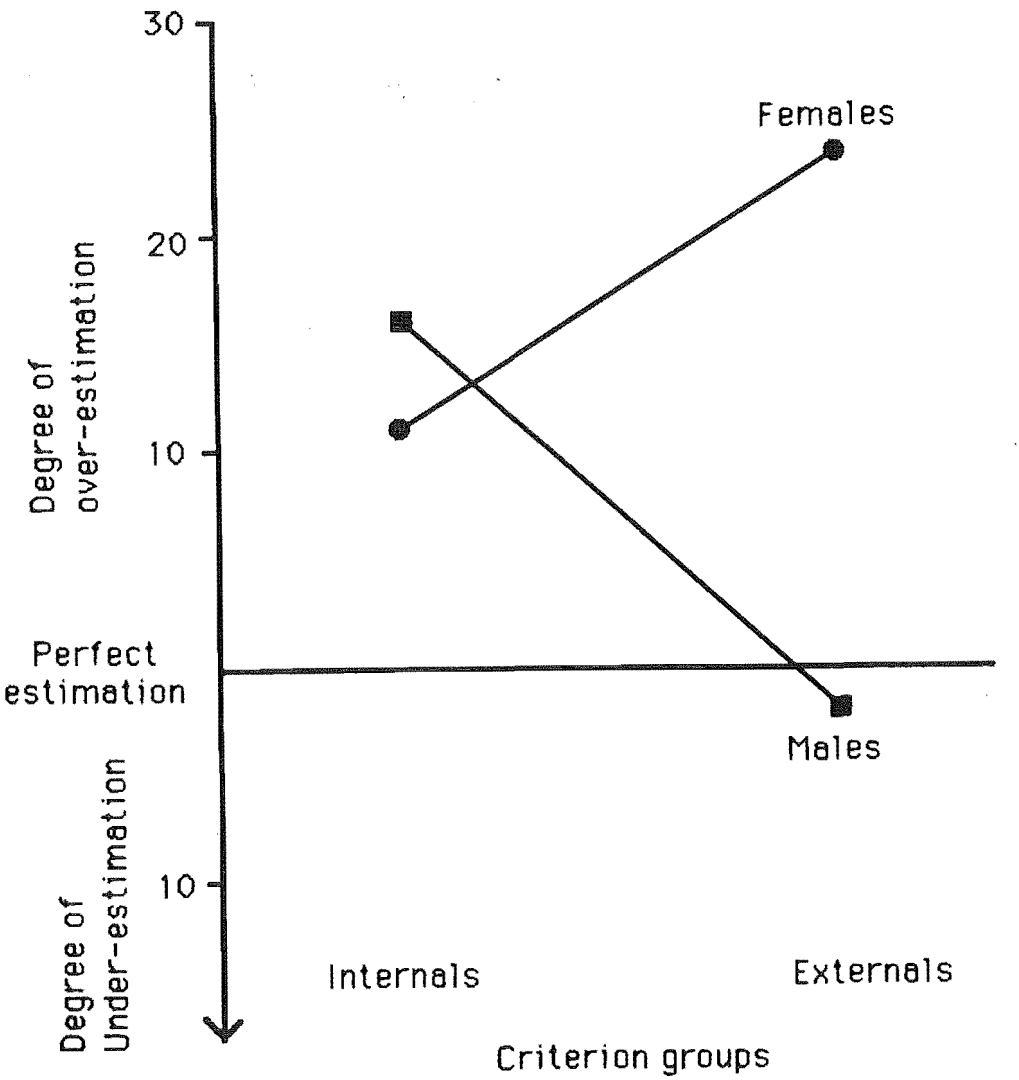


It can also be seen that a good reinforcement schedule by itself, without luck information, is enough to induce an over-estimation in the amount of money won or lost. Interpreting the results another way, information on luck has

the greatest effect when subjects were experiencing a neutral reinforcement schedule, that is, when subjects encounter roughly an equal number of wins and losses. Under such conditions of maximum uncertainty subjects exhibited a bias towards over-estimation.

The final significant relationship derived from this ANOVA was a sex by locus interaction $F(1, 24) = 4.5$, $p = 0.04$ (Figure 7).

Fig. 7. Accuracy of estimation for the 2 sexes : The mean of the actual wins/losses of males and females subtracted by their estimated wins/losses recorded after each block of 15 gambles when the 2 sexes were partitioned into internals and externals.



External males appear to estimate the outcomes of their gambles most accurately. Both internal males and females are

biased towards over-estimation with the external females being the most inaccurate group, over-estimating twice as much as the internals.

Post-experimental questionnaire survey.

The final set of analyses involve data from the post-experimental questionnaire (Appendix 9). A chi square analysis of the nominal data (on questions 3 and 4) did not reveal any significant difference (Appendix 16 and 17). An analysis of variance of the remaining data yielded one significant result (Appendix 18). Table 10 below shows the group means of the subjects' ratings of being lucky or unlucky during the game.

Table 10. Subjects' mean ratings of being lucky or unlucky during the gambling session.

		Sex	
		Male	Female
Locus of control	High	5.0	3.1
	Low	5.0	3.8

Males rated themselves differently from females in terms of thinking that they were lucky or unlucky $F(1, 27) = 12.5$, $p = 0.002$. Males rated themselves as having about average luck (5.0), whereas females appeared to feel disadvantaged, in terms of being unlucky, giving an average rating of 3.5.

Discussion

Risk-taking

There was little difference in the risk taken under neutral or good reinforcement conditions although the number of high stakes chosen was greatest in the neutral fortune condition. It is difficult to explain why under neutral conditions, that is, payoffs about 50 percent of the time (which approximates the usual situation under chance conditions), subjects took the most risks compared to the other two conditions. The interaction between fortune and information sheds some light on the situation. It is clear that when subjects were not informed they were not inclined to be risky or conservative and took roughly an equivalent amount of risk in all three fortune conditions even though there was nearly twice the number of payoffs in the good compared to the bad fortune conditions. When informed that they were going to experience luck circumstances, subjects responded to the information by increasing or decreasing their number of high bets accordingly to maximise winnings. The shift in risk-taking was most obvious when subjects were informed of impending bad luck. One possible reason is that the perception of the influence of bad luck is not equivalent to that of good luck. The present result provides support for Cohen's (1960) finding that the decrement expected to occur as a result of bad luck is three times as great as the increment which good luck is expected to bring.

One is still left with the question of why people are influenced by information on luck. Subjects were only told that they might expect to experience good, bad, or ordinary luck. In one sense, subjects may be behaving rationally in

maximising their winnings by using whatever information available. Perhaps in a situation of uncertainty, such as gambling, subjects are willing to utilise any available information to aid in their decision making. However, it must be remembered that the information concerned the possible presence of luck which is only an intangible entity. Thus, it appears that, similar to reactions in situations in learned helplessness (Abramson, Seligman & Teasdale, 1979), individuals can be made to become quite gullible by the introduction of an atmosphere of uncertainty. Although it might seem unethical this observed effect may be fruitfully incorporated into certain counselling procedures.

The observed influences of luck instructions may be merely an example of experimenter demand characteristics (Orne, 1962). Cohen's (1960) series of experiments produced evidence which contradicted this position and showed that the belief in luck and its powers is very real and pervasive as indicated by the many instances of superstitious behaviours in everyday life.

It seems that the various strategies adopted by the criterion groups did not affect the final outcome of the gambling session, that is, the end result of gambling was a fairly uniform loss of between 21 to 36 cents across all subjects. This lends some support to the assertions that psychological factors are also important in making gambling decisions.

Internals, in this experiment, showed greater risk-taking tendencies and responded more appropriately (in terms of maximising wins) to the differing fortune conditions by risking more under neutral and good payoff schedules and displaying conservatism under poor payoff schedules.

Externals were conservative in all conditions relative to the internals. Indirectly this is contrary to results which indicated that high risk-takers (gamblers) are externally orientated (Moran, 1970a; Conrad, 1978). However, Slovic (1964) speculated that the internally controlled person might become more ego involved in risk-taking contexts than his externally controlled counterpart. Strickland et al., (1966) hypothesised that the person who sees himself as `master of his fate' might well employ this disposition in a gambling situation. Instead of playing a cautious game, he should be more likely to try and outwit it, that is, commit the gambler's fallacy and be generally less consistently conservative. Likewise, the person who sees general outcomes as determined by factors outside his or her own control might well take the most conservative path in the hope that fate might not be too unkind.

Evidence for the higher risk taken by internals was shown by internals choosing the higher stakes under neutral fortune condition in which there was no apparent advantage in doing so. Higher risk-taking responses under the good payoff condition could indicate that internals were able to work out that they were enjoying a favourable circumstance and capitalised on it. In other words, there is support that internals were more attentive to the environmental cues and are more interactive with them (Phares, 1968; Williams & Stack, 1972; DuCette & Wolk, 1973).

Recall

1. The numbers chosen by subjects to place their bets on.

The recall of the numbers subjects had chosen to place

their bets on was best when the payoff schedule was bad, worst when subjects were encountering favourable payoff schedules and in the neutral fortune condition the recall accuracy fell in between these two. This observation supports Gilovich's (1983) finding that losses in gambling are better remembered. Subjects' better recall under the poor payoff schedule may be explained by the assertion that in order that losses be kept in check subjects had to be more attentive to the on-going gambling process.

Information regarding luck status of the situation only affected subjects under the neutral fortune condition. The non-informed condition may be thought of as having the most uncertainty. It is suggested that subjects cope with such an arousing predicament by attempting to learn more about the state of affairs. The lower level of recall for the informed group indicates that the information given reduces the uncertainty of the situation thus lowering the arousal experienced. Information improves the recall of the numbers chosen under conditions which are more obviously favourable or unfavourable.

2. The most and least frequently occurring number.

Externals who were informed of their luck expectations stood out as the group which under-estimated most compared to informed internals and both uninformed internals and externals. It seems that when externals, who already believed in a control of forces outside themselves, were told to expect a possible experience of luck they feel even more helpless and thus attend less to the environmental cues, in this instance, the number of times a particular number of the die that appeared.

Contrary to the hypothesis that internals are more accurate at recall tasks than externals, internals showed greater over-estimation for the least frequently occurring number compared to externals. The saliency of the number that appeared least often is proposed to explain the difference. Being more interactive with the world internals would find rare occurrences of a number more salient than externals, who have been shown in an earlier analysis, to be less responsive to environmental cues when gambling.

Hornseth (cited in Dale, 1959) and Attneave (1953) found that when people observed randomly generated events of different kinds and were afterwards required to report on the frequency with which each kind of event occurred, they tended to over-estimate the frequency of occurrence of infrequent events and under-estimate that of comparatively frequent ones. In a more recent study, Snyder (1978) concluded that both race-track betting public and expert handicappers under-estimate the chances of favourites while over-estimating the chances of success of the longer-odds horses. Good evidence of under and over-estimation of frequently and infrequently occurring events can be seen from Tables 6 and 7 respectively. The present results also show that it is not a simple case of people tending to over or under-estimate occurrences that are determined in part by chance factors, but that internals tend to over-estimate the occurrences of low frequency events more than externals whereas both internals and externals are more prone to under-estimate the occurrences of high frequency events. Further research is required to clarify the relationship between the probability of occurrences and the accuracy of estimation of those events.

3. Estimation accuracy of the amount of money staked.

As far as the estimation of the amount of money staked is concerned internals were more accurate than externals. Internals, with an assumed personal control over the situation, presumably would try to gather as much information as they can from the environment and act on the basis of those cues including keeping a better track of their bets. This would result in a smaller discrepancy between the actual amount of money staked and the estimates of the amount staked. Externals, on the other hand, did not take much notice of what they bet since they had resigned themselves to the influences of fate and chance.

4. The estimation accuracy of the amount of money won/lost during the gambling session.

Subjects informed of their luck status were less accurate, displaying greater over-estimation. Once again it may be that the uninformed group, faced with greater uncertainty, was forced to attend to the available cues which resulted in more exact estimation. Another possible explanation arises from the research on the illusion of control. When people are more certain of a future event they could experience an illusion of control (Langer, 1975; Langer & Roth, 1975). This perceived control might have reduced the informed group's need for close attention to on-going events, eventuating in faulty appraisals of their performance.

In the good and bad payoff conditions one can speculate that with greater deviations from the average chance returns (about 50 percent) from their bets, subjects tended to be

more wary of their performance. These unusual shifts from `normality' may warrant greater attention since if things get `too bad' subjects stand to lose an appreciable amount of money and if things `go their way' then subjects are able to win a substantial sum. Of the two eventualities, losing is a more worrisome prospect and this was reflected in the accuracy of the estimation- implying closer attention to the financial situation. Under good fortune conditions subjects appeared to be overcome by their success and probably exhibit `nonchalance' towards their available money in hand resulting in substantial over-estimation of the outcomes of their gambling.

In both the good and bad fortune conditions the winning and losing experiences overshadowed the influences of luck information. The effect of no information or higher uncertainty induced a need for information. This provides a reasonable explanation for the over-estimation produced by the introduction of information in the neutral condition. The relatively accurate estimation of the uninformed group can be attributed to the maximum uncertainty of the situation, that is, no notification of the luck status and an even probability of winning and losing in the gambles.

An interesting result is obtained in terms of sex difference and locus of control. External males recorded the most accurate estimation while both internal males and females over-estimated with external females over-estimating even more. With respect to age trends in the sex differences surveyed, Maccoby & Jacklin (1975) found that there is a tendency for young women of college age to lack confidence in their ability to do well on a new task, and feeling that they have less control over their own fates compared to their male

counterparts. These trends are not seen among younger or older females. The authors suggested that this may be a result of the `dating and mating game' where females traditionally play a more passive role and that this is a period of life where masculinity and femininity become most defined. These cultural stereotypes are prevalent in everyday interactions and their portrayal are widespread in the mass media. While this may explain the poorer performance of the female subjects the behaviour of external males is inconsistent with the locus of control data. Another possible explanation refers to the greater exposure of gambling experience for males than females which may account for the more accurate estimation by the external males (a possible association with gamblers who are assumed to perform better in gambling related activities). Both the better performance of internal males and females may be attributed to internals having superior recall and information utilisation to that of externals.

The post-experimental survey.

In the post-experimental questionnaire survey females thought they were more unlucky than males who thought that they were neither lucky nor unlucky. Since most subjects lost about an eighth of their given money females may be considered to be more influenced by an overall loss in the gambling session and that females felt that the gods were against them. Cohen (1960) found that the belief in being lucky was about 12 percent for females and 7 percent for males when asked before drawing a winning raffle ticket. This could reflect a general heavier reliance on luck by females which was again demonstrated in the present

experiment. On this occasion, however, it was an attribution of bad luck to account for the misfortune on the part of the females.

Although subjects were not advised of their actual balance until the questionnaire was completed, the estimated amount of money won/loss after each block of 15 trials and informal post-experimental questionning revealed that every subject thought that he or she had lost between a quarter to half the original money. This may represent a tendency for individuals to become pessimistic under unfavourable situations and to over-rate their misfortune.

One criticism of this experiment may be that of boredom-induced shifts of choices made by subjects during the session. Coombs & Pruitt (1960) showed that preferences among bets in a choice task were orderly under tedious experimental conditions. In addition, Slovic, Lichtenstein & Edwards (1965) suggested that shorter experimental sessions, individual administration and real gambling help prevent boredom-induced distortions in preferences. These recommendations were taken into account in the design of this experiment although the number of trials in each block could perhaps be reduced. The high degree of subject participation and subject-experimenter interaction provided a further improvement. The frequent breaks in gambling between blocks on 15 trials should markedly cut down boredom generated by the experimental situation. Post-experimental questionning revealed that two subjects felt a little suspicious about the randomness of the die-throws towards the end of the session. Only two subjects indicated any sign of boredom thereby signifying the relative success of the safe guards employed.

A number of ANOVAs were performed on a substantial

amount of data. In some sets of analyses only one out of 17 experimental effects produced a significant F ratio. Some of these results should be treated with caution since at a conservative level one significant result out of twenty may be expected to have arisen from chance factors alone. In one of the ANOVAs the result of the estimation of the amount of money staked should be treated with reservation since the data of 8 out of 28 subjects had to be discarded due to errors made by subjects in entering the data onto the recording sheets.

A discussion of the hypotheses.

Overall the analyses of the data yielded a number of significant results. Females, in the present study, tended to be more conservative than their male counterparts but the difference was not statistically significant. Thus, hypothesis 1 is not supported. The literature on sex differences in terms of risk-taking has focussed on a young population, that is, early teens and younger. The available research on university age, young adults have used mainly questionnaires on risk-taking which do not involve actual monetary risk-taking. Thus, these results may not be generalisable to the gambling behaviour of university students among whom there is no gender difference in risk-taking. The only significant difference between gender was the rating of being lucky or unlucky. It was asserted that females seemingly attributed their lack of success in the gambling session to bad luck whereas luck did not appear to be important for the males. The reason for the greater attribution to luck for unsuccessful gambling by females but not by males is unclear. This may reflect a feature of the

differences in attitudes and expectations in the Western socialisation process.

Contrary to hypothesis 2, internals took significantly more risks than externals supporting Slovic's (1964) speculation that internals become more daring in risk-taking contexts and try to outwit the gambling situation Strickland et al., 1966). The two studies (Moran, 1970a; Conrad, 1978) which showed that gamblers display an external orientation used gamblers as subjects which was not the case in this experiment. Furthermore, the higher risk-taking and an external locus of control relationship is not necessarily transitive.

Hypothesis 3 which states that subjects will take more risks under a favourable schedule of reinforcement than under an unfavourable schedule of reinforcement was supported. However, the results indicated that it may be more accurate to state that a low number of payoffs encouraged conservatism rather than high number of payoffs stimulating greater risk-taking. In light of this finding it is proposed that losing money is a more important variable in determining shifts in risk-taking than winning. Further studies are required to confirm this proposition.

Information on the qualities of luck was also important in changing risk-taking behaviour. Bad luck was found to exert a greater decrement in riskiness than the increment effected by good luck which supports Cohen's (1960) finding. There is an important difference between this experiment and Cohen's study. In his study there was no real difference between the lucky and unlucky situations and subjects were merely asked how they felt they would perform under those influences. In the present experiment, subjects did

experience fewer payoffs when they were informed of possible bad luck and a greater number of payoffs when informed of possible good luck. The fact that subjects in the uninformed conditions did not alter their risk-taking under the various fortune conditions highlighted the potency of information on the qualities of luck thereby supporting hypothesis 4 (luck will be discussed in greater detail in a later chapter).

In a review of sex differences, Maccoby & Jacklin (1975) found that neither sex is more susceptible to simple conditioning, or excels in simple paired associations or other forms of `rote' learning. Similarly, no difference in recall was found between male and female subjects as predicted in hypothesis 5.

Hypothesis 6 was generally supported. As far as the recall of die numbers was concerned both internals and externals were prone to error. Internals tended to over-estimate the episodes of the least frequently occurring number while both internals and externals tended to under-estimate the appearances of the most frequently occurring number. Generally, taking the estimation data into account, internals performed better than externals in the recall and estimation tasks. This was argued to be a result of the internal's closer attention to the environmental cues and greater interaction with them whereas externals appeared unimpressed and unmoved by the same stimuli.

There was also reasonable support for hypothesis 7. Recall was generally best after poor payoff conditions, the necessity to be more wary of the consequences of the gambles was suggested as a possible explanation. Gilovich (1983) showed that subjects remembered losses better, at least in the long term. He suggested that aversive events (losses)

were more salient and thus better retained in memory.

Luck information only affected recall in the neutral fortune condition and did not bias recall in either the good or bad fortune conditions. This result was contrary to that predicted by hypothesis 8. Subjects informed of ordinary luck exhibited poorer recall rather than the better recall that was expected. It was proposed that the ordinary luck information provided lowered the uncertainty of the situation which decreased the need for subjects to attend to the on-going gambling process resulting in poorer recall. Another trend that emerged from the results was that in situations of high uncertainty and where the outcome of the behaviour was of significance then information such as the possible influences of ordinary, good or bad luck decreases the accuracy of recall, probably by distracting the attentional process from the available cues. Put another way, uncertainty promotes attention and thus improves recall.

CHAPTER FOUR

GAMBLING AS STIMULUS-BOUND BEHAVIOUR?

Introduction

It has been demonstrated that the eating behaviour of overweight individuals is under external rather than internal control (Schachter & Gross, 1968; Nisbett, 1968a; 1968b; Goldman, Jaffa & Schachter, 1968). When external food cues are potent, the obese eat considerably more than do normals, while they eat less if food cues are weak or entirely absent (Ross, 1969). From such experiments it was suggested that, in the obese, eating behaviour is stimulus-bound.

The concept of stimulus-binding stimulated the idea that responsiveness to external cues in the obese might not simply be limited to eating behaviour. Rodin, Herman & Schachter (1972) tested subjects on tasks requiring them to attend to, or process, a variety of external stimuli. The obese were found to have a shorter choice reaction time, shorter tachistoscopic recognition thresholds and better immediate recall for items presented briefly on a slide (Rodin, 1973; Schachter & Rodin, 1974; Rodin, 1975). Since then a number of studies have looked at the relationship between obesity and externality (Rodin & Slochower, 1976; Rodin, Slochower & Fleming, 1977; Rodin, 1978a, 1978b; Nail, Levy, Russin & Crandall, 1981; Stager, 1981; Isbtsky & White, 1981).

Although on a number of occasions it has been shown that obese individuals performed better in various cognitive tasks, it is reiterated repeatedly by Rodin (1978a, 1978b, 1981a, 1981b) that the notion of externality is too

simplistic to account for all the observed findings. Studies by Rodin and her colleagues failed to show reliable overweight/normal weight differences consistently from subject population to subject population or even from study to study in the same population (Rodin, 1975; Rodin, Moskowitz & Bray, 1976; Rodin et al., 1977).

Rodin (1981a) pointed out that not all overweight individuals are externally responsive and not all normal-weight individuals are internally sensitive. Indeed, various studies have shown that there are people in all weight categories who are highly responsive to external cues (Levitz, 1975; Nisbett & Temoshok, 1976; Price & Grinker, 1973; Rodin et al., 1977). The major problem in the use of the internal-external distinction to explain differences between obese and normal-weight individuals is that there are no clear measures of internal sensitivity. This is partly because it has not been possible to identify unequivocally the conditioned stimuli for hunger and satiation.

However, the concept of stimulus-binding may still prove to be of heuristic value when employed in a different context. In a number of publications on the treatment and description of compulsive gambling (Seager, Pokorny & Black, 1966; Goorney, 1968; Gambler's Anonymous, 1974; Livingston, 1974), the role of external stimuli which initiate a chain of actions leading to the individual engaging in gambling has often been stressed (Knapp, 1976; Dickerson, 1984). It may not be too far-fetched to suggest that the phenomenon of a heightened responsiveness to gambling cues such as racing commentaries, racing pages of periodicals, the sight of betting-shops, playing cards, dice and the like, is characteristic of gamblers. Some of these situational

factors have also been identified as those which provide reinforcements to gamblers encouraging and `training' them to greater involvement (Dickerson, 1984; Cornish, 1978). This implied external responsiveness is evidenced by frequent warnings to affected gamblers to avoid such enticements (Livingston, 1974).

Since the effect of increased external responsiveness appears to be so pervasive it is suggested that gamblers as a group are more externally responsive to certain stimuli in a manner similar to the obese. Furthermore, the externality concept is more applicable to gambling than to obesity since it is not necessary to acknowledge the existence of an internal sensivity in gamblers. An experiment was thus devised to test the hypothesis that gamblers are more externally responsive than non-gamblers.

Method

Subjects

Fifty undergraduate volunteers from the Psychology and Economics Departments of the University of Canterbury completed a questionnaire (Appendix 2) to assess the extent of their gambling activities. Thirteen subjects who gambled at least once a week and wagered over $6 per week were classified as gamblers. Twenty-three individuals who only purchased raffle tickets or gambled less than once a year made up the non-gambler group. The mean age of the gamblers was 22.5 years ranging from 18 to 25 and the mean age of the non-gamblers was 21 which ranged from 18 to 34 years. The two samples consisted of 24 males and 12 females. In the gambler group there were 5 females and 8 males while the non-gambler group was made up of 7 females and 16 males.

Tests

1. Item recall

A cardboard box measuring 40 x 25 x 7 cm was used to hold an assortment of 20 articles of approximately similar sizes including:

1. a pencil
2. a ball-point pen
3. a ruler
4. a tooth-brush
5. a big paper clip
6. a pencil sharpener
7. a comb
8. a nail cutter
9. a table-tennis ball
11. a small pair of scissors
12. a big rubber band
13. a gate key
14. a box of matches
15. a pack of cards
16. a tea-spoon
17. a piece of chalk
18. a stapler
19. a bottle-opener

10. an eraser 20. a bottle of glue

2. Letter identification

This test comprised letters of the English alphabets which were randomly arranged in a 30 x 30 letter matrix (Appendix 19).

3. Difference detection

A set of two perfectly matching pictures with the exception of 10 minor details made up the third test. Two different sets of such pictures were used in the experiment (Appendix 20 and 21).

Procedure

All subjects were tested individually in a big and otherwise empty classroom. Subjects were told that they were participating in a series of short experiments on perception after which they had to complete a repertory grid. (Appendix 22 - The grid results will be discussed in a later chapter. Post-experimental questioning of the subjects did not indicate any interference of the externality experiments on the grid completion or vice versa. Henceforth, these studies will be treated as independent.)

Initially, subjects were informed that a box containing a number of items commonly encountered in daily living would be placed before them. They would be given 20 seconds to view the contents of the box after which it will be taken away. The task of the subjects was to try and recall as many items as they could. Subjects were given 6 minutes to list the items they thought were present in the box. All subjects gave up within the time allocated. The total number of

articles correctly remembered constituted the score for each subject (Maximum score = 20).

Next the list of random alphabets was presented to the subject. Subjects were asked to scan through the list quickly and circle all the F's printed. The score for each subject was the number of F's circled within a two minute period (Maximum score = 36).

Finally the first set of two matching pictures were presented. Subjects were told that there were 10 differences between the two apparently identical pictures. Their task was to indicate as many differences as they could detect within 40 seconds. The same procedure was followed for the second set of pictures. The score was the total number of differences located in the two sets of pictures (Maximum score = 20).

The time interval that was allowed for each task was determined in the pilot studies. The criterion for the amount of time given to perform each task was about 10 to 30 seconds less than what was required for most of the subjects in the pilot studies to complete the tasks. This was done to ensure a good differentiation among the performances of the subjects.

Results and Discussion

An analysis of variance (ANOVA) was applied to the data treating both gambler/ non-gambler and sex as independent variables. The means of the gambler and non-gambler groups are presented in Table 11.

Table 11. The mean performance of gamblers and non-gamblers in the three tests of externality.

Tasks	Gamblers		Non-gamblers	
	Males	Females	Males	Females
Item recall	13.4	11.6	11.0	11.9
Letter identification	27.3	28.0	24.1	26.5
Difference detection	12.6	12.4	11.0	11.6

The ANOVA of the externality data (Appendix 23) showed no significant difference between gamblers and non-gamblers. There was also no significant gender differences. There are several possible reasons to account for this.

1. Sampling problems - the gambler group may not be composed of individuals who are `real' gamblers. External responsiveness may be present only in people deeply involved in gambling.
2. As Rodin (1981a) pointed out, there may be just as many `external' normal weight individuals as there are overweight `externals'. The same caveat may apply to gamblers and non-gamblers, that is, there could be just as many external gamblers as there are external non-gamblers.
3. It may have been premature to search for an external responsiveness before a sensitivity to gambling cues is established experimentally for gamblers. Gamblers may only

be influenced by cues which are associated with gambling.
4. Perhaps the concept of externality does not apply to gambling, at least, to social gambling.

Recent publications by Rodin and her associates have tended to discourage the use of a simplistic internal-external responsiveness to explain overweight/ normal weight differences (Rodin, 1978b; 1981a; 1981b). Nisbett (1972) argued that the association between obese overweight and cue responsiveness is an artifact. He suggested that many less obese overweight individuals are in a state of chronic deprivation because they have not attained their biologically determined set point. It is this deprivation which produces responsiveness to external food cues. However, data by Rodin, Slochower & Fleming (1977) did not support Nisbett's hypothesis.

Another factor which appears important in the response to external stimuli is arousal. Stricker & Zigmond (1976) showed that an external stimulus can be seen as having two effects: a specific one that elicits some appropriate motivational state and a non-specific one that arouses the organism thus permitting the responses to occur. Organisms could literally be turned on by an external stimulus, and at the same time, this arousal would make them more likely to eat, perhaps because arousal reciprocally increases responsiveness to external cues. Spitzer & Rodin (cited by Rodin, 1981) obtained data suggesting a relationship between individual differences in arousability in response to external non-food-related stimuli and subsequent overeating and weight gain when subjects lived in a food abundant environment. This line of reasoning can explain arousal-related overeating without reference to psychodynamic

factors.

From the above discussion and without getting too involved in the neural systems of organisms it would seem that the internal-external distinction may be discarded and the operant term `discriminative stimuli' be adopted instead. Rodin (1978b) noted that the internal-external distinction has provided very good heuristic value for research but is no longer adequate to explain present findings. Since the behaviour discussed is a response to a stimulus it is logical to revert to the operant learning paradigm. This is appropriate for two main reasons: firstly, no internal processes are assumed and secondly, there is already a wealth of research from which to formulate hypotheses.

Discriminative stimuli are stimuli that precede and accompany operant responses. Such stimuli are called `discriminative' because they set the occasion for which the operant responses are reinforced (Fantino & Logan, 1979). In the context of gambling a gambler may be seen as more susceptible to gambling stimuli just as there is a heightened perception for food cues by a hungry person. This greater responsiveness of the gambler to gambling cues is used to explain their greater impact on gamblers as compared to non-gamblers. These gambling cues are likely to lead to a series of behaviours culminating in the participation of a gambling activity. For example the sight of a betting-shop activates the response of walking towards it, entering the building, studying the programmes, and finally placing the bet at the counter. The sequence of events just described is similar to that effected by a discriminative stimulus. To be more precise, it is a description of a discriminative stimulus functioning in a chain schedule. Each stimulus

serves both as a reinforcer for the response that produces it and as a discriminative stimulus for the next response in the chain. Domjan & Burkhard (1982) pointed out that discriminative stimuli have a powerful effect on behaviour not because they are paired with the reinforcement but because they signal how or when the reinforcement is to be obtained. This suggests that the gambling response can be readily triggerred given a wide range of available discriminative stimuli and the strength of the behaviour easily maintained without much effort due to the reinforceing qualities of the stimuli.

It appears that there may be at least one aspect of gambling behaviour which can be understood in an operant framework. Cornish (1978) concluded that,

> Incoming information about gambling may define as well as identify the needs for which it provides satisfactions. Situational determinants operating in the potential gambler's environment, such as ecologic opportunities and structural characteristics, provide the source of this information. Consequently they have an important influence in determining likelihood of gambling, though their impact has in the past tended to be neglected.

Futhermore, with the recent interest in cognitive aspects of animal behaviour some evidence was gathered to show that the state of neural excitation in the brain created by classically conditioned stimuli leads to sensations in addition to eliciting particular types of emotions and overt responses. These sensations can come to serve as discriminative stimuli for the instrumental behaviour and thereby influence instrumental performance (Domjan & Burkhard, 1982). An inclusion of motivational factors would

provide a more complete picture of the processes involved in gambling behaviour.

To summarise, the notion of discriminative stimuli is useful in the understanding of gambling behaviour especially in terms of the potency of the reinforcing qualities of the stimuli rather than an outdated internal-external stimulus-binding distinction. It is also acknowledged that motivational factors be included if an explanation of gambling behaviour is attempted.

CHAPTER FIVE

THE EFFECTS OF AROUSAL AND ENVIRONMENTAL CUES ON GAMBLING.

Introduction

The nature of the purported relationship between behaviour and the level of arousal has been explicitly questioned by a number of theorists. The first work indicating that there might be an optimal level of stimulation came from Wundt (1893, cited in Zuckerman, 1979a) who found an inverted-U relationship of pleasurable sensation with several stimulus intensities. Freud (Breuer & Freud, 1895/ 1935), in his earlier work, stated that:

> there is a tendency to preserve at a constant level the intracerebral excitement. An excess of it becomes burdensome and annoying, and there arises an urge to consume it.... I believe that we can assume a level of the intracerebral tonic excitement, namely that it also has an optimum. On this level of tonic excitement, the brain is accessible to all external stimuli.

Freud also stated that `agitation' may be produced by excitement in excess of or below this optimal level.

Other more behaviourally orientated researchers such as Yerkes and Dodson (1908) proposed a law which stated that learning involving easy discriminations or simple associations is facilitated by high levels of stimulation, whereas more difficult learning proceeds optimally at some intermediate level of stimulation. Hebb (1955) noted that when arousal or drive is at a low level, a response that

produces increased stimulation and greater arousal will tend to be repeated. But when arousal is at a high level further stimulation will be avoided thus signifying that there is an optimal level for effective behaviour.

Lindsley (1951) conceived of the reticular formulation as a homeostat regulating the inflow of sensations to the cortex by allowing more stimulation to reach the cortex when it is under-aroused and a reduction when there is an overload. Schlosberg (1954) attempted to produce a 3-dimemsional theory of emotions including pleasantness/ unpleasantness, attention/ rejection, and activation (arousal). He also stressed the importance of the diurnal cycle in the variation of the optimal level of arousal. Another proponent of the optimal arousal concept, (Duffy (1957), suggested that individuals may differ in arousal for either genetic or environmental reasons, and such differences may affect their temperaments.) Individuals with a fast alpha rhythm in the EEG (high arousal) are characterised as quick, impulsive and variable in behaviour, whereas those with slow alpha are rated as cautious and steady suggesting that the optimal, or accustomed, level of arousal may be the basis for sensation-seeking-type behaviour.

The investigators mentioned above were interested in the relationship between levels of tonic arousal and emotion, learning or performance. Other researchers emphasised on whether learning and performance are affected by any deviation from an adaptational level at the time of stimulation on the organism. (Bain (1875, cited in Zuckerman, 1979) stated that stimulation of the senses within certain limits of intensity was said to be pleasurable but beyond these limits becomes painful. He outlined his Law of

Relativity as follows: "Change is necessary to feeling; we are unconscious of unremitted impressions; the degree of feeling is proportional to the change; abruptness or suddenness of transition is one mode of enhancing the effect."

Bain also formulated the Law of Accommodation which describes the tendency for intensity of either negative or positive feelings to subside with repetition of the stimulus or situation eliciting them. In an attempt to integrate learning theories Leuba (1955) suggested that, at any one moment, optimal stimulation could be represented by a band somewhere between the minimal and the excessive. The basic postulate of Schneirla's (1959) theory is that for all organisms in early ontogenetic stage, low intensities of stimulation tend to evoke approach reactions and high intensities withdrawal reactions, with references to the source. Berlyne (1960) talked about an optimal arousal potential and discussed the human proclivity to seek emotional experience and excitement either in real life or vicariously through art or entertainment, the self-inflicted stress being generally mild or else short-lived. Another similar inverted U-shaped curved was proposed by Fiske & Maddi (1961) in terms of an organism's activation level to account for the most efficient behavioural function.

The effects of excitation and inhibition represented the final theoretical basis of the optimal level construct. The works of Pavlov (1927/ 1960) and Hull (1943) appear to suggest that the optimal level may be conceived of a balance between excitation and inhibition, that is, the nett excitation after the subtraction of inhibition. In personality research Cattell (1950) suggested that the

high-surgent (dominant) individual is characterised by a low level of arousal of the sympathetic nervous system and is therefore more complacent and disinhibited. H.J. Eysenck (1967) updated his previous analysis of introversion/ extraversion by attributing the trait to differential thresholds in the various parts of the ascending reticular activating system rather than on the relative excitation-inhibition characteristics of the cortex. The introvert would have a supersensitive activating system capable of producing high cortical arousal with a minimum amount of stimulation, whereas the extravert would require higher amounts and intensities of stimulation to reach an optimal level of arousal.

Zuckerman (1979a) did a thorough review of the studies on optimal arousal and more specifically on sensation-seekers. He suggested that sensation-seeking is a displaceable motive, that is, it can be satisfied by a variety of activities, which may provide the key to dealing with its less socially desirable manifestations such as drug abuse. Although accepting that it is plausible for expressions of a trait to be influenced by social forces Zuckerman was clearly biased by findings of research in psychopharmacology and psychophysiology. He hypothesised that the sensation-seeking trait is in part a function of the levels of the catecholamines, norepinephrine and dopamine, in the reward areas of the limbic system, as well as the neuroregulators, such as monoamine oxidase (MAO), that control their availability at the synapses within these neural systems. High levels of dopamine in the norepinephrine pathways would result in high activity and the tendency to explore new situations. High levels of

norepinephrine would be related to the expectation of positive reinforcements from persons or situations, providing part of the motivation to take social or physical risks.

More recent writers (Corcoran, 1981; M.W. Eysenck, 1982) supported the notion of an arousal system governed by the inverted U-shaped function but generally favoured a more complicated multi-dimensional arousal system. In Corcoran's model the multi-dimensional theory assumes an origin in multi-dimensional space in which the co-ordinates are the many and diverse effects of mild and extreme stressors. It permits one to speak of arousal level, degree of arousal and differences in arousal within and between subjects. Some of the postulates of H.J. Eysenck's current view of the relation between personality and arousal were considered and the assumption that arousal level is a function of degree of current stimulation was deemed essentially correct. It was suggested that the assumed tendency of subjects to engage in activities to optimise arousal was in a sense empty, though nicely related to contemporary notions of stress, and to the distinction between strategy and state.

In a comprehensive review of attention and arousal research M.W. Eysenck (1982) concluded that a two arousal system appeared to best explain the experimental findings. He argued that the apparent great flexibility with which the human processing system copes with very low or very high levels of arousal is perplexing for advocates of a uni-dimensional arousal theory since the results simply attest to the involvement of an active compensatory system. In other words, arousal does not exert a direct effect on behaviour but has indirect effects which are mediated by a central control system. However, it is often difficult to

distinguish between the passive arousal state and the compensatory effort response.

M. W. Eysenck proposed that with a two-arousal system model a reasonable level of performance can be achieved in at least two different ways: 1. near-optimal arousal with little need for compensatory effort or, 2. sub- or supra-optimal arousal combined with much compensatory effort (that is, at high `cost' to the system). It is wrong to conclude from the existence of a non-significant effect of arousal on task performance that arousal has no effect at all on internal processing. On the contrary, comparable efficiency on the part of control and highly aroused subjects is often achieved at greater `subjective cost' to the more aroused subjects (that is, reduced processing effectiveness). There is evidence that the ability to resist at least some kinds of environmental distraction is markedly reduced in states of high arousal (Howarth, 1969; Morgenstern, Hodgson & Law, 1974; Pallak, Pittman, Heller & Munson, 1975).

Although two separate systems have been identified they are often inter-dependent in their functioning with each system having definite effects on the other arousal system. When arousal in the passive arousal system is non-optimal for the task in hand, there will typically be enhanced activity of the compensatory system. The compensatory system responds to task demands and attempts to maintain task performance at a satisfactory level. If the attempt to do so is unsuccessful, then this produces arousal in the passive arousal system.

A. Arousal and gambling

It is hypothesised that gamblers represent a sub-group

of sensation-seeking or individuals with a higher thresholds of stimulation to reach an optimal level of arousal combining both Zuckerman's (1979a) and H.J. Eysenck's (1967) theories respectively. The differential thresholds in the various parts of the ascending reticular activating system account for the differences between introverts and extraverts while the differential thresholds in the entire limbic systems account for the neuroticism trait. H.J. Eysenck (1963) also proposed that the optimal level of tonic arousal is lower for introverts than for extraverts. This was used to explain the behavioural differences between introverts and extraverts. It is asserted that gamblers are characterised by a preference for monetary risk-taking over other arousing activities such as physical or social risk-taking. Basically the proposed model of the motivational characteristic of gamblers is similar to H.J. Eysenck's neuroticism or extraversion. In other words, gamblers represent a sub-group of sensation-seekers who are characterised by a higher optimal level of arousal than the average person and also have a correspondingly high stimulation threshold. Part of this sensation-seeking propensity is hypothesised to be a result of the sub-optimal arousal in the gambler's arousal system. However, instead of considering the gambling propensity as a trait it is more prudent at this stage to describe it as a construct in the same way Rotter (1975) referred to his internal-external control of reinforcement. One good reason for doing that is that gambling propensity represent only a very narrow `trait', unlike H.J. Eysenck's three dimensions of personality, and data supporting its existence have been meagre. Nevertheless, personality studies have provided some support for the model. The

results of the previous study on personality characteristics showed that pathological gamblers scored higher on the neuroticism scale than non-gamblers and social gamblers. High neuroticism is the only consistent personality trait that has been identified in pathological gamblers besides having an external locus of control and Bergler (1943; 1958) described the gambler as a misunderstood neurotic.

Non-personality studies are reviewed in the following section to ascertain the viability of the model. Knowles, Cutter Walsh & Casey (1973) showed some convergence in a number of risk-taking measures with gambling which indicates that gamblers may be able to and do indulge in other activities to achieve in optimal stimulation comparable to the `displaceability' of activities in sensation-seeking (Zuckerman, 1979a, b). The four-dimensional interpretation of risk-taking outlined by Jackson, Hourany & Vidmar (1972) includes: 1. monetary risk-taking entailing financial gambles; 2. physical risk-taking concerning taking chances involving bodily harm or physical risk to the person; 3. ethical risk-taking involving taking chances in situations which normative ethical values are involved and, 4. social risk-taking concerning situations in which the person's esteem in the eyes of others may be at stake. In this context monetary risk-taking is probably the `cheapest', in terms of energy expenditure, and least `disastrous' form of arousing activity, in the sense that a thrill, excitement or arousal may be obtained with relatively small negative consequences. However, a negative consequence or a loss of some kind is essential to be arousing. Cutter & Heilizer (1968) argued that the operational definition of risk-taking requires that something of value be at stake. Perkins (1950)

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stated that besides unavoidable risk, in gambling, the possession of money is determined solely by chance. Although the outcome may not be completely chance-determined there is inevitably an element of uncertainty. It is proposed that the unknown outcome, of varying probabilities, of either a monetary loss or gain, creates an attractive arousing situation for gamblers but does not provide the same pleasure for non-gamblers.

It has been observed that a majority of gamblers tend to increase the size of their wagers after becoming involved in gambling for some time (see the review in Cornish, 1978) and from the over twenty years involvement with gambling by the author it was observed that most gamblers tend to place higher wagers during the course of an individual gambling session as well. In other words, gamblers usually start off with stakes that are low and build up to what they can afford (sometimes cannot afford) and/or feel inclined to risk. Depending on the gambler's experience, social environment, financial situation and motive for gambling the agreed `limit' for wagers may be reached slowly or quickly or he/she may not get to that amount at all. The size of the stakes that predominates during the gambling session will depend on the above factors which could be seen as an example of Helson's adaptation level (Helson, 1947; 1948; Helson, Dworkin & Michels, 1956). And in line with the addiction literature, the amount of arousal required to attain the optimal or preferred arousal level increases as gamblers acquire `tolerance' to monetary risk-taking. In behavioural terms, higher stakes and/or longer gambling sessions are required to bring about the same level of arousal activation.

Other relevant points are the responses of gamblers

under higher arousal or under different kinds of arousal, that is, arousal which is in addition to that experienced as a result of gambling (Anderson & Brown, 1984) and the effects of these different arousing influences respectively. Cohen (1964) proposed that a situation involving danger disrupts the regulating mechanism and enhances risk-taking. Another interpretation to account for such an increase in risk-taking by individuals was that high arousal may be related to denial of threat (Rule, Nutter & Fischer, 1971) and a tendency to ignore cues of punishment (Hare, 1968).

In the present model, it is proposed that gamblers have a distorted regulating mechanism under conditions of over-arousal due to gambling activities. Although disrupted, the regulating mechanism continues to function but at a dampened capacity. Stimulus specificity in the stimulus-bound behaviour may be relevant, that is, the excitement, denial of threat and other emotional components experienced by the over-aroused gambler may not be generalisable to other activities which evoked these emotional responses. For pathological gamblers, a different set of motivational forces is suggested to dominate. These are manifested in the form of psychological dependence where the pleasurable effects of thrill, financial gain and other positive concomitants of gambling become secondary to a reduction of negative withdrawal effects such as irritability, restlessness, depressed mood, poor concentration, obsessional thoughts and somatic disturbances (Wray & Dickerson, 1981). Furthermore, the arousal regulating mechanism becomes severely impeded by the effects of psychological addiction. This could explain the common observation that pathological gamblers frequently gamble till

their last cent is gone (Livingston, 1974).

Research on the relationship between gambling and arousal is sparse. Most of the data obtained may be interpreted in terms of the traditional inverted U-shaped arousal curve. One related early study suggested that intolerance of ambiguity increases after exposure to stress (which consists of threats to the subjects' self-image), reflecting an over-arousal effect (Smock, 1954). Brim & Hoff (1957) showed that subjects that were frustrated exhibited the greatest desire for certainty and that subjects that were satisfied exhibited the least desire for certainty, with the control subjects desiring an average amount of uncertainty. This provides further support for the inverted U-shaped arousal function.

The Sensation Seeking Scale (SSS) was developed to measure a general sensation-seeking tendency which involved some enjoyment of tension-raising situations (Zuckerman, Kolin, Price & Zoob, 1964). In a gambling situation, the results of Walters & Kirk (1968) provided validation of the general SSS form in terms of risk-taking behaviour, that is, the sensation-seeking tendency is negatively correlated with a lower probability of winning higher payoffs. Zuckerman (1974) found that male subjects who preferred the gambling project over sensitivity or alpha training scored higher than the norms on the Disinhibition scale of the SSS IV. The small group of females differed significantly from the norm group on three scales: General, Experience Seeking and Boredom Susceptibility.

The nature of risk-taking makes it easy to associate it with arousal. Slovic (1964) specifically contended that arousal is an important component in risk-taking. Support

for the inverted U-shaped function in terms of gambling behaviour came from Steiner, Jarvis & Parrish (1970) whose rating showed that high arousal is associated with lower levels of risk-taking. A similar trend was found by Kozlowski (1977) who demonstrated that subjects characterised by a strong demand for stimulation were found to prefer low probabilities (high risk) and subjects with a weak demand for stimulation favoured high probabilities (low risk). Moreover, larger significant differences were obtained in the higher payoff condition.

However, not all data supported the inverted U-shaped model of arousal. Lieblich (1968) found that there is a general trend to take greater monetary risks when subjects are experiencing stress as compared to the no-stress condition. Investigating the effect of arousal on risk-taking, Rule et al. (1971) obtained results which indicated that risk-taking increases over trials in the low and high arousal conditions but decreases over trials in the moderate condition. In an attempt to consolidate the empirical evidence a two-factor approach was suggested by Rule et al. in which at lower levels of arousal risk is taken to increase or decrease arousal to some optimal level whereas at high levels of arousal greater risk is taken as a denial of threat. This proposed two separate arousal mechanisms, one which accounts for risk-taking at low arousal and the other operating at high arousal levels, is appealing in the current status of arousal theory which favours a multi-dimensional model (Broadbent, 1971; Corcoran, 1981; Eysenck, 1982). However, empirical evidence for such a model of arousal in gambling is still inadequate.

B. Effects of reinforcement history upon gambling behaviour.

Studies which have dealt with sequential effects in choice situations (Jarvik, 1951; Nicks, 1959; Anderson, 1960; Anderson & Whalen, 1960) generally showed that predictive behaviour on any given trial is a function of the results of the preceding trials. It is further agreed that the probability of predicting an event E increases and decreases as the length and run of the E events increases, but the point where the run curves reach their peak and alternating occurs remains equivocal (Anderson, 1960; Anderson & Whalen, 1960).

Myers & Fort (1963) found that choice behaviour is largely a function of expectancies generated by the preceding pattern of events and hypothesised that sequential effects are themselves functions of the ordering of events. The peak of the run curve usually occurs after 3 consecutive similar events. Furthermore, the data indicated that choice behaviour is a function of the preceding pattern of responses as well as stimuli. No consistent decision to gamble or not to gamble was found under varying amounts of gain and loss although in the long term the probability of gambling following a losing gamble steadily declined.

In a summary of his previous research on probability and variance preferences, Edwards (1962) concluded that an individual's choice among gambles is essentially independent of the amount of money won or lost on previous trials unless the sum is `substantial'. Slovic, Lichtenstein & Edwards (1965) investigating the differences between make-believe sessions and gambling for real money also found that betting behaviour is apparently unaffected by past payoff history.

On the other hand, McGlothlin (1956), in an analysis of pari-mutuel betting (horse-race punting) found some indication that losing bettors increase the size of their wagers more than winning bettors.

Greenberg & Weiner (1966) failed to show any significant relationship between the amount of money won or lost and the 3 indicators of risk preference used; probability, variance and potential winnings. However, subjects who had an equal number of wins and losses tended to be more conservative and subjects who had high or low reinforcement ratios preferred the high risk gambles. Greenberg & Weiner concluded that the reinforcement histories differentially affected the subjective probabilities. They argued that the low-ratio group exhibited a negative recency effect or `gambler's fallacy' (Jarvik, 1946) in assessing their chances of winning, while the high ratio group exhibited a positive recency effect (Senders, 1953).

Cohen (1970) showed that, in a binary event, winning and losing have a differential effect on the next choice of outcome. After losing there is a much stronger expectation that the alternative outcome will appear but there is some indication that the belief in the alternative outcome occurring is stronger after a win since the mean stake placed on the alternative outcome after a win is higher than the mean stake placed after a loss. In general, a variable strategy of betting is prominant, that is, there is a tendency to increase the stake after winning and to decrease it after losing. Cohen also noted that his adult and youngest (10+ years) subjects appeared to be maximising the utility of play, that is, to prolong the experiment, as a game, for as long as possible. By contrast, the middle group

(14+ years) seemed bent on minimising their losses rather than maximising their gains.

Cohen (1972) pointed out that the common implication that winning and losing have similar effects on subsequent play could have arisen from a failure to distinguish between the gambler's fallacy and negative recency. In the case of negative recency the individual's choice is only affected by his knowledge of previous outcomes and previous choices, by their accuracy or otherwise. The distinction between negative recency and the gambler's fallacy is that something more is at stake beyond the choice. Whether a stake is raised or lowered does not depend merely on whether a choice has been correct or not, an additional component, a positive recency effect, could be present which expresses itself as a generation of uncertainty to challenge oneself and to impress the onlooker.

In a recent study, Leopard (1978) showed that the majority of her subjects took more risks when they have lost than when they are ahead. Secondly, many subjects were influenced by run patterns of wins and losses in the amount of risk they took, but the nature of the influence depended on the individual. A number of suggestions were put forward to explain her results. Subjects' perceptions of the risk involved in the choice to play in a given game may vary. It follows that subjects' subjective evaluations of the likelihood of winning change with the outcome history as they play. Thus, subjects who believed in the gambler's fallacy would be encouraged to increase their stakes after a run of losses, 'expecting' a win. On the other hand, those who believed in runs of luck would expect more wins when winning and more losses when losing and bet accordingly. This

interpretation is rather similar to Greenberg & Weiner's (1966) hypothesis of the group receiving low reinforcements exhibiting a negative recency response and the group receiving high reinforcement exhibiting a positive recency response.

Morgan (1983) found that his subjects who predominantly lost in the early trials of the experiment made riskier decisions during the losing period than during a period in which winning is more regular. He also found that the initial winners and break-even group followed different patterns of risk preference over time than did initial losers by not changing strategies. These results led Morgan to argue that it is losing, not winning, which produces changes in individual preference of risk.

The only study to use criterion groups to assess the effects of different reinforcement histories was carried out by Hatano & Inagaki (1977). Their results showed that extraverts tended to make `riskier' choices more in and after prolonged favourability of reinforcement but made `less risky' ones significantly more in unfavourable reinforcement sequences than introverts.

On the whole, the available evidence favours the notion that reinforcement history in sequential gambling is an important determinant of future wagers. How wins and losses, and runs of wins and losses affect subsequent bets remains unclear and the reasons for these effects are even more ambiguous.

C. The importance of gambling cues in gambling behaviour.

From the apparent failure of Experiment 3 to show any

stimulus-bound characteristics in gamblers, it was suggested that only gambling-related cues have any influence on the behavioural responses of gamblers, in this case, gambling behaviour. It was also proposed that the presence of gambling cues would stimulate both gamblers and non-gamblers but have a significantly greater effect on gamblers. The gambling cues serve as discriminative stimuli which set the occasion for gambling activities and act as reinforcements as well if the gambling behaviours occurring within a gamble is seen as chain of events. The individual gamble may also be interpreted as components which make up the series of events denoted as the gambling session. These cues are considered to have a minimal effect on non-gamblers since the stimuli have little discriminative value in the non-gambler's behavioural repertoire.

Most gambling research has ignored the possible effects of such a parameter which might have influenced the results especially when the characteristics of betting between gamblers and non-gamblers were compared.

D. Chance, skill and risk preferences in gambling.

Starting some 25 years ago, Cohen and his associates carried out extensive research into the relationship between skill and chance preferences in gambling and have uncovered valuable empirical evidence which has been repeatedly cited in the gambling literature.

In an early study, Cohen, Dearnaley & Hansel (1958) showed that in a complex situation involving two sources of uncertainty, the subjective probablility of success in performance is equivalent to the product of psychological values relating to each separate source. However, the

psychological measurements of probabilities, chance, skill and randomness are frequently distorted, though often in a predictable pattern (Kahneman & Tversky, 1982; Teigen, 1983a, b, c, d).

Cohen (1970) found that choice preferences in a chance situation are non-random. The smaller the initial mathematical value of small chances the more they are over-valued, and the larger the initial mathematical value of small chances the more they are under-valued. It was suggested that the `over-valuers' may be `thrill-seekers' stemming from the greater uncertainty whereas `under-valuers' are more externally controlled in the sense that they believed luck to be the major determinant of success.

Other investigators (Tune, 1964; Kahneman & Tversky, 1982; Teigen, 1983a) have looked at how patterned sequences affect behaviour or judgements of randomness. In general, people do not have a clear understanding of what randomness is. Events are considered not to be chance-determined and seen as non-random when a sequence contains prominant features. For example, in six tosses of a coin 3 heads followed by 3 tails or vice versa are subjectively less random than the sequence H T T H T H. Judgements under uncertainty are further influenced by three heuristics: 1. Representativeness - usually employed when people are asked to judge the probability that an object or event A belongs to class or process B; 2. Availability of instances or scenarios, employed when people are asked to assess the frequency of a class or the plausibility of a particular development and, 3. Adjustment from an anchor, usually employed in numerical prediction when a relevant value is available (Tversky, & Kahneman, 1974).

Decisions are often made which deviate widely from those based solely on mathematical probabilities (Cohen & Hansel, 1958). The main differences between the subjective and objective probabilities are that the value of the probability of a multiple additive choice is under-estimated and the value of a multiplicative probability is over-estimated. In general, values of psychological probabilities seems highly dependent on particular situations, personal preferences and beliefs. Slovic (1969) also showed that there is a very strong tendency for people to over-estimate the probability of a multiplicative compound event. The situation becomes even more complicated when the influence of the contribution of skill and/or chance factors are considered. Langer (1976) noted that there is a frequent lack of discrimination between controllable and uncontrollable events. One explanation for this is that skill and chance factors are closely associated in peoples' experience. Every skill situation contains possible chance elements, and every chance situation contain possible skill elements. Moreover, a positive or negative experience in a series of events influence the perception of skill or chance control of the events. Langer & Roth (1975) found that subjects participating in a purely chance task (predicting the results of a series of coin-tosses), the outcome sequences of which were manipulated by the experimenters to produce a winning run either early or late in the sequence, subjects are more likely to attribute skill to the prediction task if they have had the experience of a winning run early in the sequence. A series of successes at the beginning of a sequence would also influence the players to over-estimate their chances of success. In an attempt at replication, Ladouceur & Mayrant (1984) obtained ambiguous

results. The authors suggested that the illusion of control is found mainly in certain games with a population already sensitised or involved in gambling. The distinction between skill and chance situations becomes even less clear since positive outcomes are most often attributed to the actions that precede them regardless of the actual contingency (Bruner & Revusky, 1961; Golding & Rorer, 1972).

Cohen & Hansel (1958) found that when given a choice on the types of gambles, subjects prefer to rely more on skill than on chance activities. Langer (cited in Langer, 1976) obtained similar results. Once again the relationship is not a simple one since Cohen (1970) showed that each individual may attach different weights to the role of chance and skill in determining the outcome of an event. What seems to the observer to be essentially a matter of chance may be regarded by the participants as governed by his skill. Thus, horse and dog bettors do not look upon themselves as playing with chance to any considerable extent. They only place their bets after careful deliberation, in the belief that they have selected the winning horse or dog on the basis of its superior capacity and other relevant conditions. Those attracted to horse- and dog-racing are disposed to draw a distinction between themselves and football pool punters who (in their eyes) are true gamblers. Nevertheless, a sizeable number of pool punters and roulette players see themselves as engaging in a task requiring skill in seeking a predictable pattern of outcomes, though in fact, each outcome is unpredictable.

A number of investigators have shown the importance of other parameters of gambling. The variance and probability preferences of a gamble play a key role in determining

choices among risky alternatives (Edwards, 1953; 1954a, b; McGlothlin, 1956; Coombs & Pruitt, 1960). Other research supported related concepts such as subjective probability and utility (Edwards, 1955), expected value (Lichtenstein, 1965; Rachlin & Frankel, 1968), utility of gambling (Royden, Suppes & Walsh, 1959) and beliefs about the relative importance of probabilities and payoffs (Slovic & Lichtenstein, 1968).

Further research demonstrated that these concepts are inadequate in explaining risky decisions. Lichtenstein et al., (1969) found that expected value is not a good guide to gambling decisions even when the concept is carefully explained and displayed to the subjects. Montgomery & Adelbratt (1982) obtained similar results except in cases where repeated gambles are allowed. They suggested that instead of using an abstract measure, expected value, to guide their decisions, subjects may try to use concrete patterns of features such as high gains and high probabilities or some combinations of the two dimensions.

Some investigators argued that there is more than one dimension in a gamble (Slovic & Lichtenstein, 1968; Lindman, 1971; Payne & Braunstein, 1971). These people demonstrated that a gamble is a multi-dimensional stimulus whose various attributes have differential effects on individual decision-making behaviour. Evidence was presented showing that choices and attractiveness ratings are primarily determined by the probability of winning or losing a gamble while bids are more influenced by the amount to be won or lost. The amount to win determines the attractiveness of the bet whereas the dislike of a bet is primarily determined by the amount to lose. Using the same bidding procedure, the amount to win dominate bids but not choice of gambles

(Lichtenstein & Slovic, 1971). There is no starting point in choosing, whereas in bidding, subjects start with the amount to win and adjust it downwards to account for other attributes of the bet. In an extension of laboratory studies, casino patrons were also found to employ different strategies when choosing among pairs of bets than when attaching monetary values to single bets with payoff cues being an important determinant (Lichtenstein & Slovic, 1973). The author commented that these results seem to violate previous risky-decision models but could be understood in terms of information-processing considerations.

There have been attempts to explain gambling behaviour which were rather similar to arousal or sensation-seeking which was discussed earlier. Portfolio theory was an attempt to explain gambling behaviour by assuming that people may like to seek some risk (Coombs, 1975; Coombs & Huang, 1970). The theory assumes that preferences for risky options are determined by two dimensions, expected value and perceived risk. For each expected value an individual is supposed to have an ideal level of risk at which his preference will be maximal. Deviation from this ideal risk either towards higher or towards lower risk will reduce preference. Strict risk aversion is considered to be a special case where no risk is the ideal risk level. As in the structure of a gamble, perceived risk is also identified as having more than one dimension. Using a multi-dimensional scaling technique, Nygren (1977) showed that it is a powerful tool in identifying the characteristics of perceived risk. From his analyses, perceived risk is revealed as both a meaningful and measurable characteristic of gambles and that any descriptive theory of gambling behaviour must include the concept.

Another feature of research in gambling is that the possibility of a loss seems to be an influential factor in gambling behaviour. Edwards (1954) found that subjects tend to change their betting habits when they lose money, but not when they win. In an experimental study of risk preference in lotteries, Coombs, Donnell & Kirk (1978) demonstrated that there is a trend for the probability of losing dominating the effect of the amount to win. The importance of an element of a loss in defining perceived risk was upheld by Slovic's (1967) results which showed that the perceived risk is determined by the probability of losing a gamble. Kietlinski (cited in Kozielecki, 1975) found that subjects consider two variables in estimating risk; the subjective probability of a loss and the amount to be lost. The product of the two variables amounts to the expected loss or risk.

Kahneman & Tversky (1982) suggested that in risky choices preferences between gains are risk-aversive and that preferences between losses are risk-seeking. Furthermore, a risky prospect is weighted by its probability, that is, low probabilities are commonly over-weighted but intermediate and high probabilities are under-weighted relative to certainty.

The final important influence on gambling behaviour is, of course, the gamblers themselves. Significantly less research has been directed to learning about the effects of personality parameters on gambling behaviour compared to the more quantifiable constructs, at least, mathematically. Atkinson (1957), in an analysis of risk-taking behaviour, proposed that preferences for different probabilities of achieving success or avoiding failure are related to individual differences in motivation. Using Atkinson's model, Littig (1963) found that when motivation to achieve

success is stronger than motivation to avoid failure intermediate probabilities of success will be preferred, and when motivation to avoid failure is greater than motivation for success intermediate probabilities of success will be avoided. From an entirely different perspective, that of marketing methods of the legitimate gambling industry, the motives toward which appeals are made include: 1. rational-economic motives, 2. recreational motives and, 3. prestige-seeking motives (Hess & Diller, 1969).

In spite of the differences which might have arisen from the variety in the mode of presentation of gambles (Aschenbrenner, 1978), it is still obvious that a large number of factors affect gambling behaviour. The most consistent finding points to the importance of losses which can be conveniently incorporated into the concept of perceived risk. This perceived risk is influenced by a number of variables such as the nature of the gamble, its representativeness and availability. It is also generally accepted that, given the choice, people prefer a task with a certain amount of skill involvement rather than chance. However, results from personality research associated with gambling behaviour is too sparse to form any firm conclusions.

Rationale and hypotheses

Little research has been directed at comparing the risk-taking or probability preference of gamblers versus non-gamblers. Nevertheless, popular literature, moralists, economists and politicians have repeatedly expounded the gambler's love for risk and uncertainty. Often these expositions are based more on personal experiences and biases

rather controlled investigations. The main purpose of this experiment is to provide data to identify some characteristics of social gamblers and to clarify some of the differences between social gamblers and non-gamblers.

In view of the literature reviewed, several hypotheses were formulated for this experiment:

1. It has been pointed out that an average individual would prefer a game which involves an element of skill rather than total chance control. Moreover, previous research has suggested that gamblers have an external locus of control (Moran, 1970a; Kusyszyn & Rubenstein, 1971; Conrad, 1979) and it is also commonly commented that gamblers have a great affinity for uncertainty. Thus, it is hypothesised that gamblers would opt for uncertain alternatives and prefer more chance than skill involvement in a game as compared with non-gamblers.

2. Social gamblers would be expected to be more interested in gambling than non-gamblers. This would be shown by the extended length of time spent gambling and the greater enjoyment experienced during the gambling session as compared to non-gamblers.

3. Social gamblers process information about the gambling environment in a different manner than do non-gamblers. They tend to over-estimate the probability of eventually winning in their gambling pursuits. It is assumed that social gamblers pay more attention to success events than failure events, and so, in judging (calculating - from a gambler's perspective) on-going chances they are working from a data base which has an over-representation of success events. Assuming also that social gamblers are rational, it follows that they would be more optimistic and risk greater amounts

of money than non-gamblers.

4. Related to Hypothesis 3, social gamblers would be less affected by immediate wins and losses than non-gamblers. Social gamblers, with their history of gambling, would be sensitised to such fluctuations in fortune resulting in a continuation of the existing behaviour. Thus, sequences of wins and losses would create little change in betting, expectations of winning and making correct predictions for gamblers but hypothesised to be influential in the gambling decisions of non-gamblers.

5. Gambling cues, being associated with a familiar activity for gamblers would be more meaningful to them. These cues would create a more realistic gambling atmosphere thus inducing more intense gambling and taking more risk in the decisions on the part of the gamblers but having relatively little impact on non-gamblers.

6. From the perspective of an inverted U-shaped function of arousal and performance and the proposed model of the under-aroused, sensation-seeking social gambler, highest risks would be taken by social gamblers under the non-arousal condition with lower risk taken in the exercise-arousal condition (physiological - assumed to be of shorter duration) and the least risk taken in the video-arousal condition (psychological - assumed to be longer lasting). These arousals would exceed the optimal level of arousal and become disagreeable to the normally-aroused, non-sensation-seeking non-gambler thereby reducing the risk taken. Social gamblers would be hypothesised to take greater risks in order to achieve more an optimal level of arousal.

Method

Subjects

A gambling assessment questionnaire (Appendix 24) was administered to 263 introductory psychology students during laboratory classes. Ninety-six volunteers were selected from the total sample and assigned into two groups of 48 non-gamblers and 48 social gamblers on the basis of their responses to the questionnaire. Non-gamblers were defined as people who never gambled or take risks with money or have only gambled less than once a year. Subjects who gambled or took monetary risks at least once a month and risking more than $3 were classified as social gamblers*. More than half of the gamblers in the sample were gambling more frequently and with higher stakes.

None of the non-gamblers enjoyed gambling whereas nearly all the gamblers included in the sample enjoyed gambling. The mean age of the non-gambler group was 19.6 years ranging from 17 to 38 years and the mean age of the gambler group was 20.7 raanging from 17 to 41 years.

*For the sake of brevity the word social will be omitted in the text in the results section.

Materials

Two packs of playing cards, a one-, two-, and ten-dollar note (New Zealand currency), a mahjong set, a set of six dice, 300 used race-track betting tickets, 80 race-track programmes (containing forms, owners and breeds of horses in the race-meeting), a book entitled `Positive Addiction', an ergometer, a video recorder and tape, a heart-rate monitor, a

photo-electric-plethysmograph, an Apple II microcomputer with the accompanying disk drive and monitor.

Tests

1. A repertory grid consisting of 11 elements pertaining to gambling situations and 12 constructs which are emotions associated with these situations (Appendix 25).
2. A pre-experimental questionnaire (Appendix 26).
3. A post-experimental questionnaire (Appendix 27).

Procedure

Subjects took part in the experiment individually in a room 3 m by 4 m. On arrival subjects were greeted and briefly informed that they were participating in a study on the relationship of arousal to their heart-rate.

Subjects were first required to complete the repertory grid followed by the pre-experimental questionnaire. Each subject was randomly assigned to one of 12 conditions. Both groups of gamblers and non-gamblers were assigned to the same conditions resulting in a 2 x 2 x 2 x 3 design, that is, gambler/ non-gambler by win/ lose first by gambling cues/ no cues by film/ exercise / reading totalling 24 cells in all with 4 subjects in each cell (see Table 12).

Table 12. The 24 experimental cells of the independent variable and experimental manipulations.

GAMBLERS	win-first	gambling cues	reading
			exercise
			anxiety film
		no gambling cues	reading
			exercise
			anxiety film
	lose-first	gambling cues	reading
			exercise
			anxiety film
		no gambling cues	reading
			exercise
			anxiety film
NON-GAMBLERS	win-first	gambling cues	reading
			exercise
			anxiety film
		no gambling cues	reading
			exercise
			anxiety film
	lose-first	gambling cues	reading
			exercise
			anxiety film
		no gambling cues	reading
			exercise
			anxiety film

Arousal

Subjects in the film condition were shown a 3-minute video clip (developed by the Psychology Department, University of Melbourne) of a series of pictures depicting a hand being subjected to various forms of mutilation. The clip consisted of 10 5-second exposures followed by a 14-second pause between the following scenes:

1. A slap on the hand by another hand.
2. A pinch on the skin of the hand by another.
3. A pin-prick on the index finger.
4. A hit on the hand by a ruler.
5. A knock on the thumb by a hammer.
6. Fingers being jammed in a door-way.

7. Burning of the index finger by a lighted match.
8. Pouring of boiling water on the hand.
9. Gashing of the palm with a carving knife.
10. Chopping off the fingers with a meat-cleaver.

Subjects in the exercise condition were required to pedal on a `Tunturi' bicycle ergometer for 3 minutes at a constant rate of about 35 revolutions per minute with a crank torque of about 15 newtonmetre which will require about 50 watts per minute or 150 watts for the whole exercise. This was shown to be enough to raise the heart-rate of an average individual appreciably.

Control subjects were asked to read the introductory pages of a neutral book (Positive Addiction) for 3 minutes.

Gambling cues

In the gambling cues condition a number of gambling implements and materials associated with gambling were present on the bench surrounding the computer screen. This included: 2 packs of playing cards, a mahjong set, 6 dice, 13 New Zealand dollars, 300 used race-track betting tickets and 80 race-track programmes. The bench was clear in the no-cues situation. In addition, during the actual gambling session the cues condition resembles a real-life gambling situation in terms of audio and visual stimulation. In the no-cues condition, the outcome of the rolls of 3 dice were simply presented as a set of 3 numbers. In the cues condition, however, pictures of 3 brightly coloured (blue, red and green) dice were drawn on the screen one after the other. The resultant picture on the screen was equivalent to a view of 3 coloured dice placed on a horizontal surface seen at an angle of 60 degrees. Following the dice display 3 `beeps'

sounded whenever a correct number was chosen signifying a winning bet. Six `beeps' sounded when the subjects was to be paid twice the amount they staked, that is, whenever the number that was wagered on turned up on two dice.

Reinforcement history

The number of wins and losses and their occurrence in the 30-trial sequence were predetermined. Half the subjects were put in the win-first condition in which 8 single, 1 double wins and 7 losses were experienced in the first 15 trials (Set A). The other half of the subjects experienced 6 wins and 9 losses in the first 15 trials (Set B) which is defined as the lose-first condition. The series of 30 gambles were split into two sets of 15 trials with the wins and losses in the sequence arranged so that there would be minimal interference in the reinforcement order at the initial and final stages of each set (Appendix 28). All subjects were given the same number of wins and losses.

On completion of the repertory grid and the pre-experimental questionnaire subjects' heart-rates were measured. Subjects then carried out whatever activity that was required in their arousal condition after which the second heart-rate reading was taken. The third heart-rate reading took place after the 3rd gambling trial, followed by the fourth and fifth reading which were taken after the 13th and 28th trial respectively. The heart-rate measuring procedure simply involved clipping a photo-electric-plethysmograph onto the index finger (or any other preferred digit) and noting down the most stable instantaneous display on the heart-rate monitor. The whole

process usually took between 10 and 25 seconds. Even though the heart-rate measurements were only part of the cover story for the experiment, every effort was made to make it appear convincing but at the same time not to disrupt the flow of the gambling session.

Following the second heart-rate measurement, subjects were then exposed to the rules of the game and instructions for betting via the monitor (Appendix 29). Two trial sessions were given with the option of additional practice gambles. When the subjects were sure of the whole procedure the experiment proper began.

Each trial consisted of 5 responses in the following order:

What do you think is the chance of you winning in this trial?

RESPONSE

A six-segment box containing a number each from 1 to 6 appears.

Choose a number from the box above.

RESPONSE

How much do you want to stake?

(Your limits are from 0 to 50 cents).

RESPONSE

What is the chance of you making the right prediction in this trial?

RESPONSE

The result of the gamble is presented followed by the statement "you have won/lost X cents" together with the current balance.

Are you ready for the next trial?

RESPONSE

After 15 trials an additional question follows the one above.

If it were possible would you like to stop now?

RESPONSE

(All subjects were given 30 trials regardless of the response to this question.)

After the 30th trial the previous question was replaced by; You have played the required number of trials. However, if you are still interested you may continue for a few more trials. Do you want to continue?

RESPONSE

The maximum number of trials given was 35. Subjects were never told at any stage the number of gambles they were going to get to ensure that the length and position of the trials do not bias the size of the wagers and the estimate of the likelihood of success.

Subjects proceeded to complete the post-experimental questionnaire after taking the last gamble. Finally, subjects were offered a choice of payment for participating in the experiment. Subjects could either accept half of their final balance after the series of gambles or draw a marble out of a bag containing 11 marbles. These marbles were marked 0, 1, 2, ... to 10 denoting one tenth of the percentage of the final balance which would constitute the alternative payment for participation.

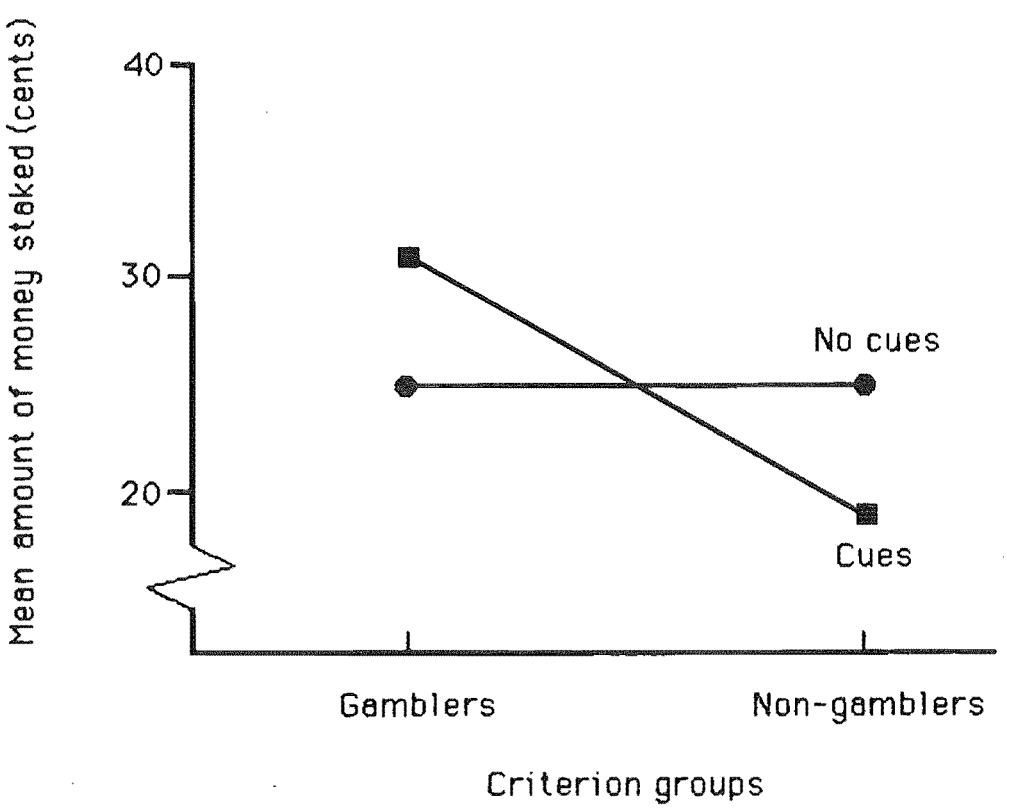
Results

The results were analysed using a 2 (GAM - gambler/non-gambler) x 2 (WILO - win-first/lose-first) x 2 (GCUE - cues/no cues) x 3 (AROUSAL - exercise/video/read) multivariate analysis of variance design for repeated measures.

1. Betting

The first analysis involved the mean bets for all the 30 trials taken together (output in Appendix 30). Predictably, gamblers (mean bet = 28.1 cents) bet significantly higher stakes than non-gamblers (mean bet = 22.5 cents) overall, $F(1,74) = 4.8$, $p = 0.03$. However, there was a significant 2-way interaction between GAM by GCUE. The relationship between gamblers and non-gamblers in their reaction to gambling cues can be seen in Figure 8.

Fig. 8. The effect of gambling cues on the staking behaviour of gamblers and non-gamblers.

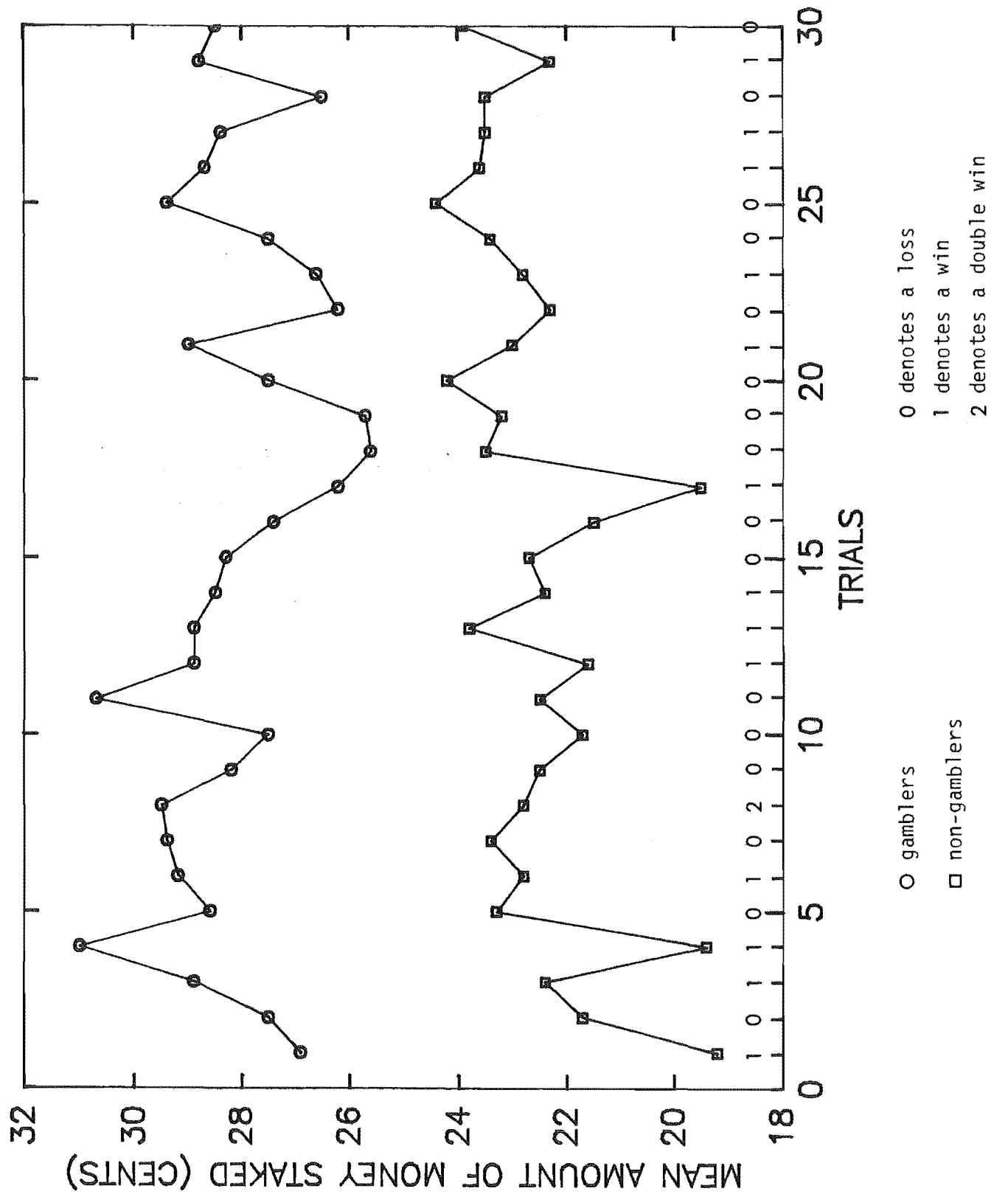


The graphs indicate that when no cues were present both gamblers and non-gamblers have nearly identical betting styles in terms of the mean amount of money staked. The situation changed drastically when gambling cues were present, gamblers increased their stakes while non-gamblers decreased theirs, by a similar amount. The types of arousal experienced and receiving more payoffs either early or late in the session did not seem to affect the amount of money wagered.

To gain a general impression of the trend in betting the mean stakes of all the 30 gambles were obtained for both gamblers and non-gamblers (Figure 9).

A distinctive feature of the gamblers' betting pattern is the strong influence of payoffs of the previous gamble and often the outcomes of a run of gambles. A general betting strategy for gamblers is to increase their stakes after losing gambles and decrease their stakes after winning gambles. This trend is fairly consistent over the 30 trials and is most pronounced when there is a run of more than one winning or losing gamble. Non-gamblers, in the main, appear to adopt the opposite strategy, that is, increasing the size of a bet after winning and decreasing the size of the bet following losses. Non-gamblers are also slightly more variable in their betting behaviour compared to gamblers. With the exception of Trials 5 and 17, most of the variations in stakes placed by non-gamblers are smaller than the ones demonstrated by gamblers.

Fig. 9. The mean amount of money staked by gamblers and non-gamblers over the 30 trials.



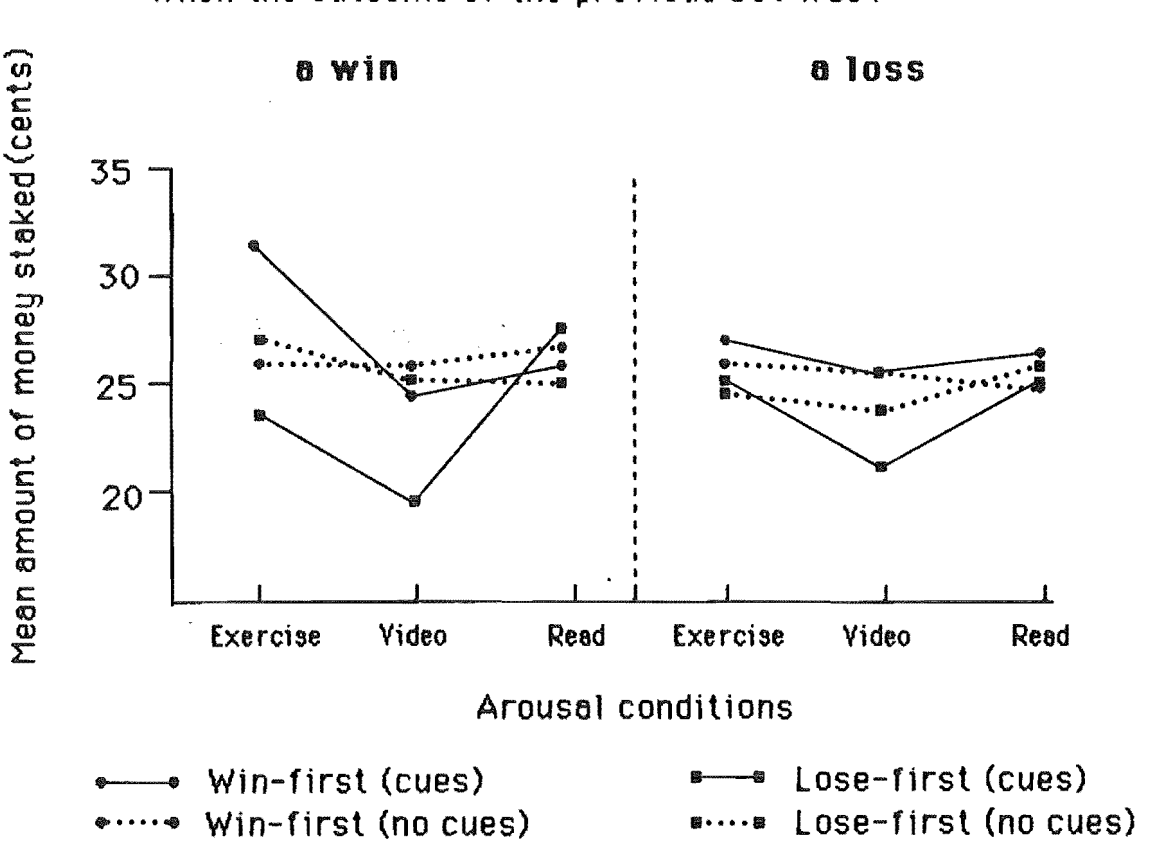
Next, the trials were separated into two groups; one in which the gambles were preceded by a win in the previous gamble and the other in which gambles were preceded by a loss in the previous gamble. Trials 1 and 16 were eliminated for this analysis since for half the subjects these two trials were not preceded by any previous outcome being the first trial in the gambling sequence. This would enable a comparison of the effects of a winning or losing outcome on the next bet in sequential gambling. The mean bets of the gambles following the 14 winning and 14 losing trials were analysed using a MANOVA design for repeated measures (Hull & Nie, 1981), the output of which can be seen in Appendices 31 and 32. There was a significant GAM main effect, $F(1,72) = 4.6$, $p = 0.035$. Gamblers (mean bet = 28.2 cents) bet a higher amount of money compared to non-gamblers (mean bet = 22.7 cents) for gambles preceded by a win or loss. There was also a significant interaction of GAM x GCUE which looks almost identical to the GAM x GCUE interaction for the 30 trials combined (see Figure 8). This is hardly surprising since the only difference between the two analyses is the exclusion of Trials 1 and 16 in the present analysis.

There was also a WILO x GCUE x AROUSAL x OUTCOME interaction, $F(2,72) = 3.5$, $p = 0.036$. This interaction is shown in Figure 10.

The major difference in the amount of money staked following a win or loss is mainly in both the arousal conditions having experienced a poor reinforcement schedule first, in the absence of cues. In other words, arousal decreases the amount of money staked only when the gambling situation is plain, without any audio or visual accompaniments, and when subjects have previously experienced

an unfavourable payoff ratio (33 %).

Fig. 10. The effects of the outcome of the previous bet, arousal, having good or bad reinforcement schedule first and the influence of cues on the amount of money staked.



On an a priori basis, an analysis of every trial in the 30-gamble sequence would not only be impractical but also redundant, thus, only a number of trials that were assumed to be important were selected for more detailed analyses.

These included 8 trials where, on the preceding trial(s), subjects encountered the following outcome to their gamble:

Trial	Outcome
5	2 wins
7	1 win
9	1 double win
12	2 wins followed by 3 losses
15	3 wins
21	1 win followed by 3 losses
23	1 loss
26	2 losses

A detailed sequence of the positions of the winning and losing gambles in the 30-trial betting session can be seen in Appendix 28.

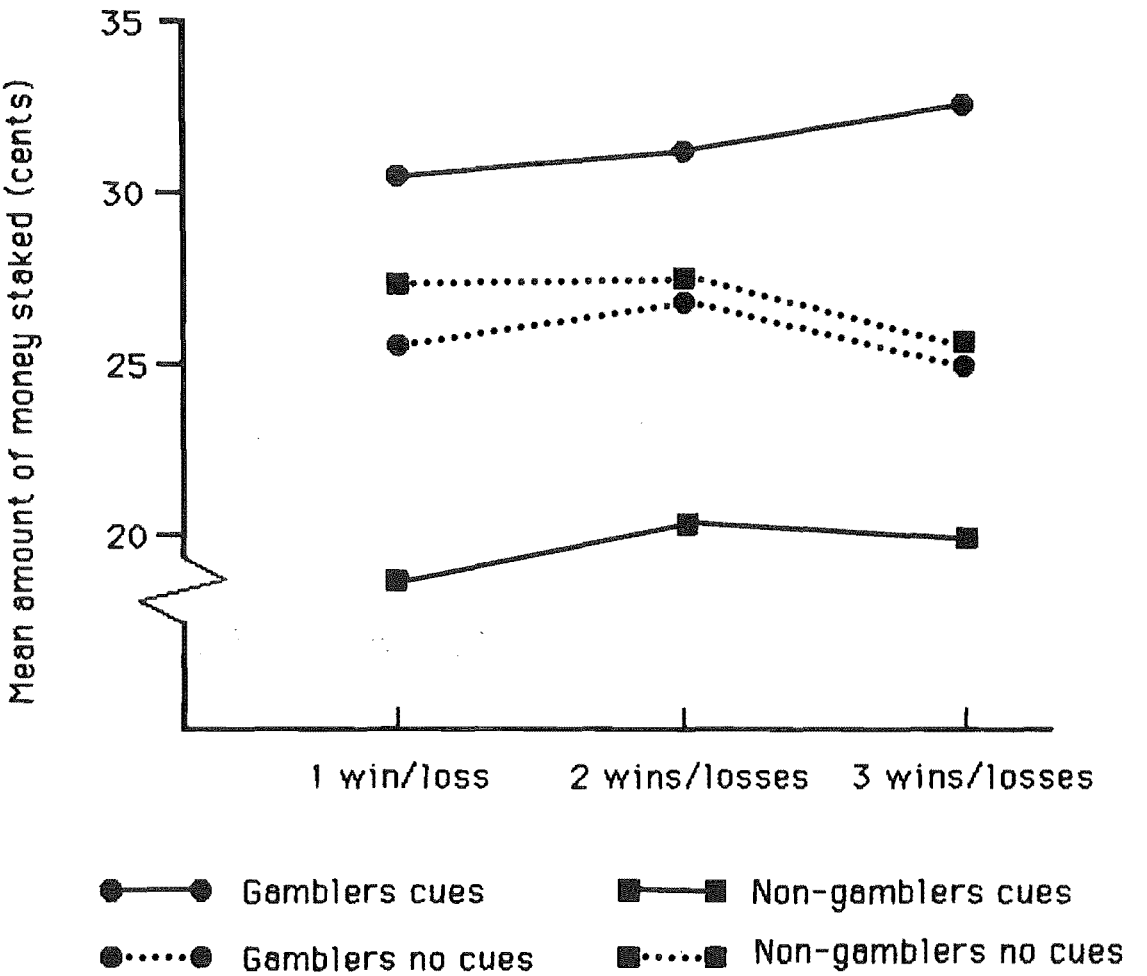
Winning and losing appeared to have differential consequences in sequential gambling (Cohen, 1970). The most discriminating trials, in the sequence of gambles, would presumably occur following these gambles. One of the major aims of this experiment is to investigate the influence of winning and losing outcomes on the amount of money staked in the next gamble. An extension of this inquiry is the effect of a double payoff on the preceding trial (a very favourable outcome) compared with the trial which was preceded by a double payoff followed by 3 losing trials in succession (that is, a pleasant result followed by 3 unpleasant outcomes). A related analysis looked at the influence of runs of 1, 2, or 3 winning or losing outcomes on the betting behaviour of gamblers and non-gamblers and the changes in betting effected by these runs of wins and losses.

The bets in the after-double-win and

after-double-win-3-losses trials were analysed using a MANOVA design for repeated measures (output in Appendix 32). Again a significant GAM main effect was found, $F(1,72) = 4.8$, $p = 0.032$. Gamblers (mean bet = 28.6 cents) bet more money than non-gamblers (mean bet = 22.1 cents). There were no significant interactions except for a near significant 5-way interaction of GAM x WILO x GCUE x AROUSAL x OUTCOME, $F(2,72) = 3.1$, $p = 0.051$, the output of which is shown in Appendix 33. The only sensible thing that can be said about the interaction is that the amount of money staked in the after-double-win-3-losses trial is much more variable than the after-double-win trial for both gamblers and non-gamblers. All the factors seem to have a little influence on the stake size or risk taken without any systematic variation.

The bets of the trials following the 1 win/loss, 2 wins/losses and 3 wins/losses were analysed using a MANOVA design for repeated measures (output in Appendices 34 and 35). There was a GAM main effect, $F(1,72) = 4.1$, $p = 0.046$. As expected, gamblers (mean bet = 28.4 cents) staked higher amounts of money than non-gamblers (mean bet = 23.1) following trial(s) with outcome(s) of 1, 2, and 3 wins and losses. A significant GAM x GCUE interaction was present, $F(1,72) = 5.5$, $p = 0.022$, shown in Figure 11.

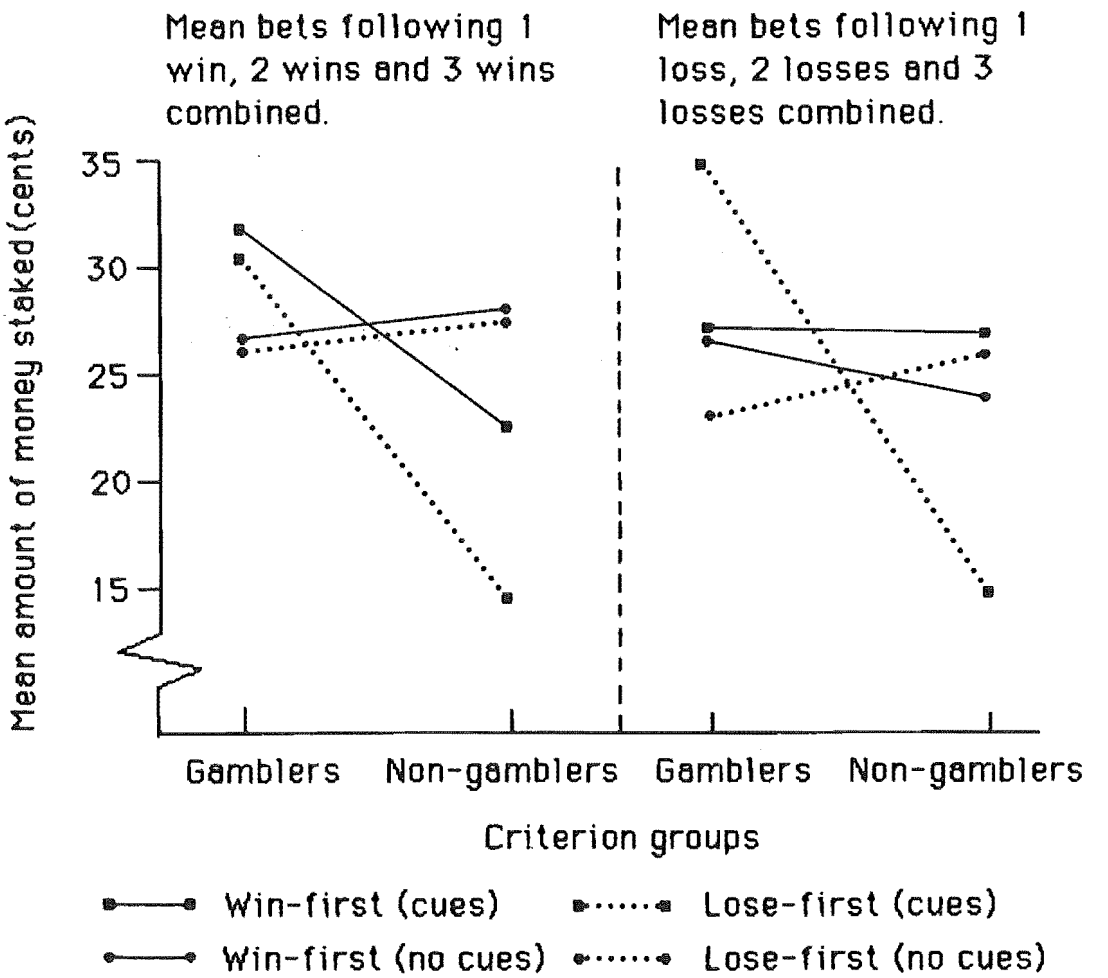
Fig. 11. The effect of gambling cues on the betting behaviour of gamblers in terms of the stake size following 1, 2 and 3 wins/losses trials combined respectively.



When there were no gambling cue present the amount of money staked by gamblers and non-gamblers was fairly similar but with cues present gamblers bet a higher amount of money than when without cues and non-gamblers bet a corresponding lower amount of money following 1, 2, and 3 wins/losses.

Another significant interaction is that of GAM x WILO x GCUE x OUTCOME, $F(1,72) = 5.3$, $p = 0.024$ (Figure 12).

Fig. 12. The effect of the outcome of bets following 1 win/loss, 2 wins/losses and 3 wins/losses combined, having good or bad reinforcement schedule first and the influence of cues on the amount of money staked by gamblers and non-gamblers.

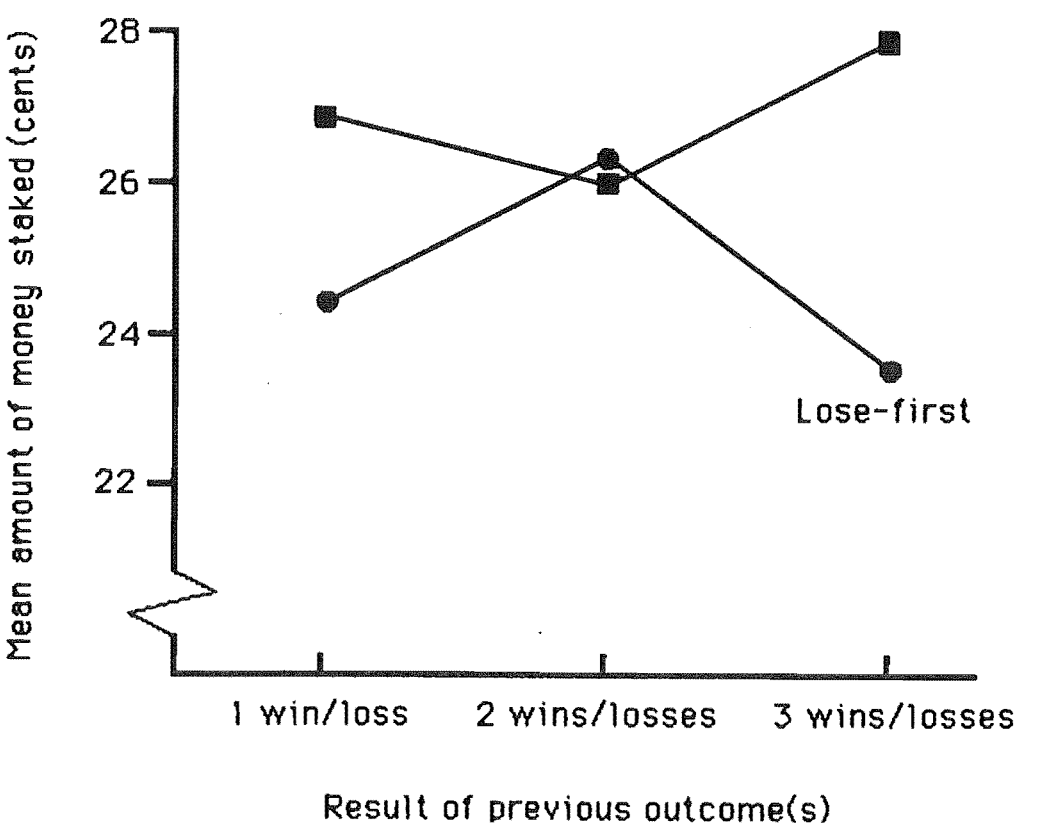


Following wins there is no difference in betting between gamblers and non-gamblers in the absence of gambling cues. With cues present gamblers increased the size of their bets regardless of whether they had a good or poor payoff history first. For non-gamblers, although they decreased their bets after experiencing both good or poor payoff history first, losing in early gambles lowered the risk taken in terms of

the amount of money bet. A feature of the interaction following losses is in the lose-first situation with cues present. Gamblers took distinctively higher risk than non-gamblers, who were comparatively very cautious. Again, there is not much difference between the gambler and non-gambler groups without cues present as in the win-first, cues situation. Comparing the risks taken after runs of wins or losses the most notable feature is the effect of reinforcement history in the presence of cues. Gamblers increase their stakes while non-gamblers correspondingly lower the stakes under the same conditions.

The analyses which looked at the effects of having runs of either wins or losses showed a significant 2-way interaction involving WILO x RUNS, approximate multiple F = 3.7, p = 0.03 (Hull & Nie, 1981, using Rao's (1973) calculation for the F ratio), shown in Figure 13.

Fig. 13. The effect of having a run of 1, 2 and 3 wins or losses on the amount of money staked when subjects have a good or poor reinforcement schedule first.



For subjects encountering 1 win/loss in the previous outcome the amount of money staked after experiencing an unfavourable reinforcement history was lower than that staked after experiencing a favourable reinforcement history. Reinforcement history did not have any effect on the trials which occurred after a run of either 2 wins or losses. However, in gambles preceded by a run of 3 wins/losses the effect was the same as that for the after-1-win/loss except that the amount of money staked was higher following a run of 3 wins/losses and lower when preceded by the after-1-win/loss trial.

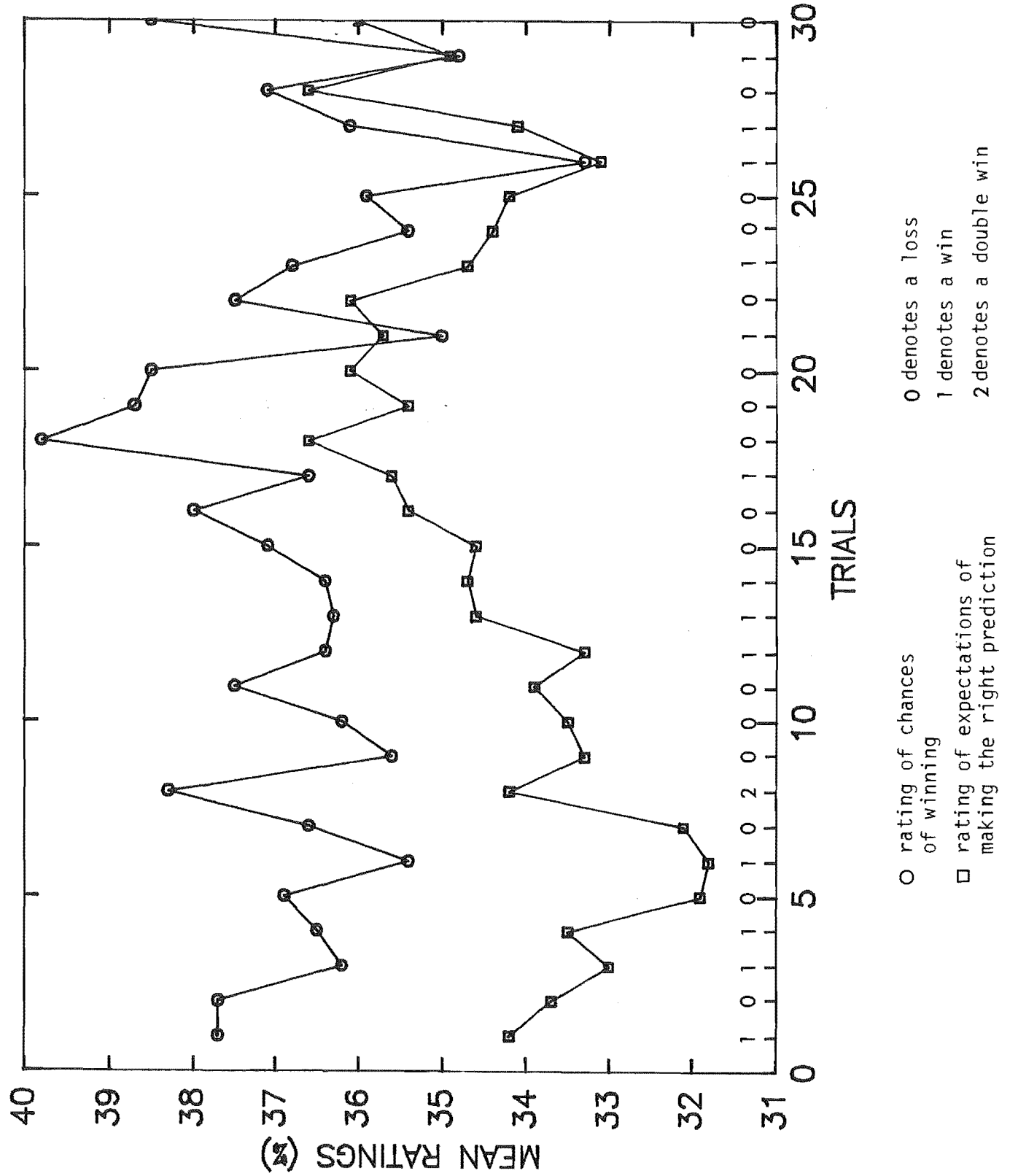
2. Estimates of the chances of winning and making correct predictions.

An ANOVA was performed on the expectation of winning and making correct prediction data on the 30 trials taken together (output in Appendix 36). The overall mean expectation of winning was significant, $F(1,74) = 4.7$, $p = 0.033$. Gamblers (mean expectation = 40.6 %) were more optimistic than non-gamblers (mean expectation = 22.5 %). After the betting procedure gamblers were again more confident (mean expectation = 38.0 %) than non-gamblers (mean expectation = 30.8 %), this time of making the right choice, $F(1,74) = 4.0$, $p = 0.048$. The other almost significant main effect was the AROUSAL manipulation, $F(2,74) = 3.1$, $p = 0.051$. Expectation of the chances of winning was highest in the video-arousal condition (mean expectation = 42.2 %), followed by the no-arousal condition (mean expectation = 36.3 %) and lowest of all in the exercise-arousal condition (mean expectation = 31.5 %).

In the next analysis, the means of both the rating measures over each of the 30 trials were obtained with the ratings of both the gamblers and non-gamblers combined (see Figure 14).

Subjects' estimation of their chances of winning and making correct predictions over the 30 trials follow a similar pattern with the major exceptions on Trials 17, 21 and 26, where there were runs of 2, 3 and 2 losses preceding those trials respectively. In Trial 17, while the chances of winning was estimated to be lower than the previous gamble, the estimation of making the correct prediction was increased. Ratings of correct predictions decreased less markedly from the previous trials than ratings of chances of winning on Trials 21 and 26.

Fig. 14. The mean combined ratings of the chances of winning and the expectations of making the correct prediction of gamblers and non-gamblers over the 30 trials.



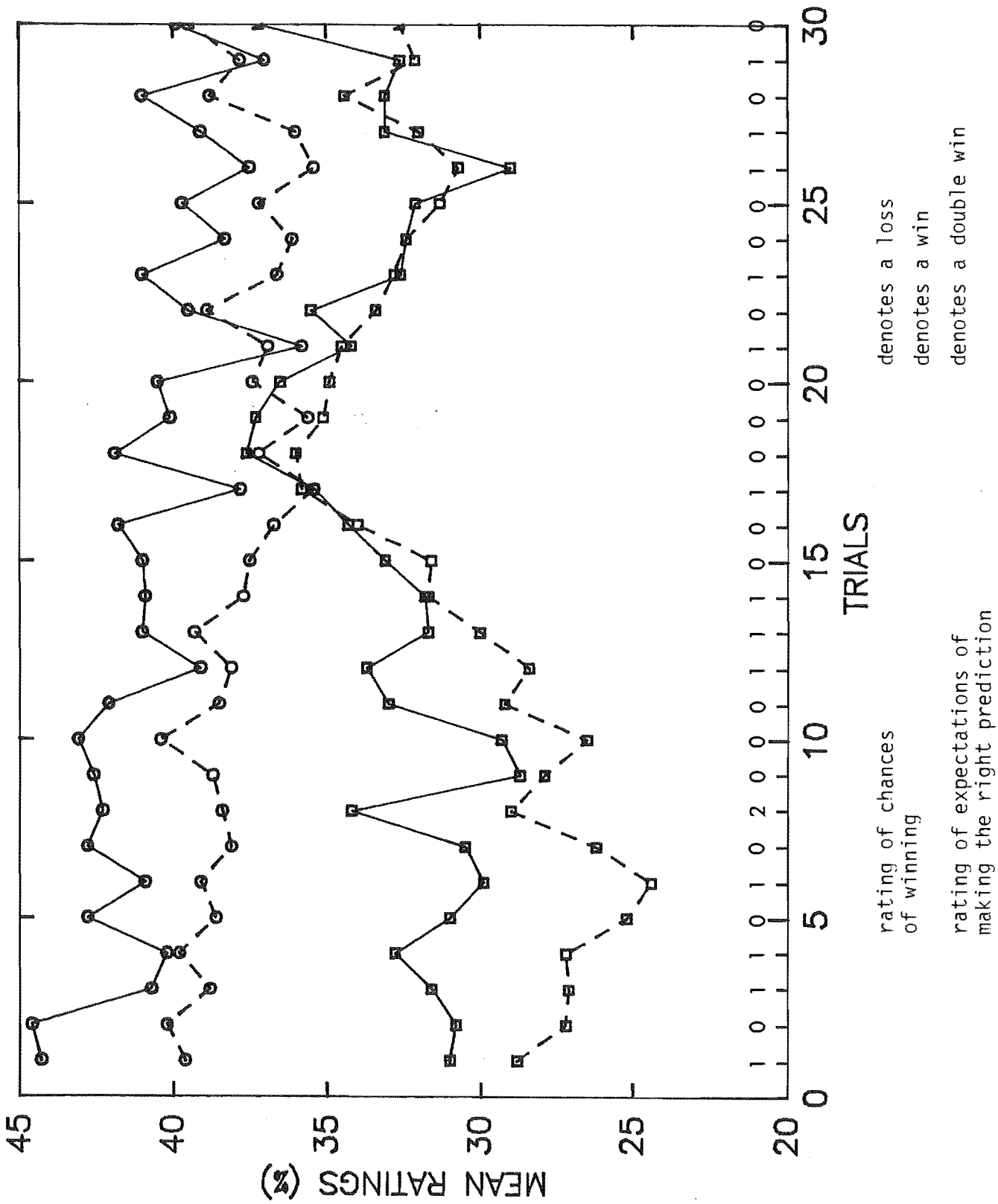
Overall, it appears that changes in the winning-chance ratings are sharper and more influenced by the outcomes of recent gambles, with losses encouraging a more optimistic estimate of winning and wins stimulating a more pessimistic estimate in the first lot of 15 trials. The trend was reversed in the last 15 trials. The dominant influence on estimates of correct predictions appears to be the overall sequence of wins and losses. Under a series of favourable payoff gambles the ratings of correctly predicting the next gamble increased steadily but generally decreased slowly following a run of unsuccessful wagers.

Since a significant GAM main effect was obtained in both the rating measures ($F(1,74) = 4.73$, $p = 0.033$ for winning-chance estimation and $F(1,74) = 4.04$, $p = 0.048$ for correct-prediction estimation) the gamblers ratings and non-gamblers ratings were compared. Figure 15 shows the ratings of the two groups on the two rating measures.

The general pattern shows that gamblers were more consistent in their ratings of both chances of winning and making predictions than non-gamblers. The overall mean ratings steadily drop on both measures with a slightly greater decrease in the mean rating of chances of winning.

For non-gamblers, the overall pattern shows two sharp rises in estimates for both measures starting from Trials 12 and 27, and a sharp fall beginning from Trial 19.

Fig. 15. The mean ratings of the chances of winning and the expectations of making the correct prediction of gamblers and non-gamblers over the 30 trials.



In the poor payoff condition, estimates of the two measures were very similar compared to the favourable payoff condition in which the ratings of the chances of winning were nearly always higher than the ratings of correct predictions. The latter trend also characterised gamblers' ratings. The mean ratings of both the gambler and non-gambler groups converges from Trials 16 to Trials 22 which represented a period of the worst payoff in the series of 30 gambles. While both gamblers and non-gamblers lowered their ratings subsequent to the runs of losing gambles, non-gamblers were particularly sensitive registering a sharp decrease in ratings.

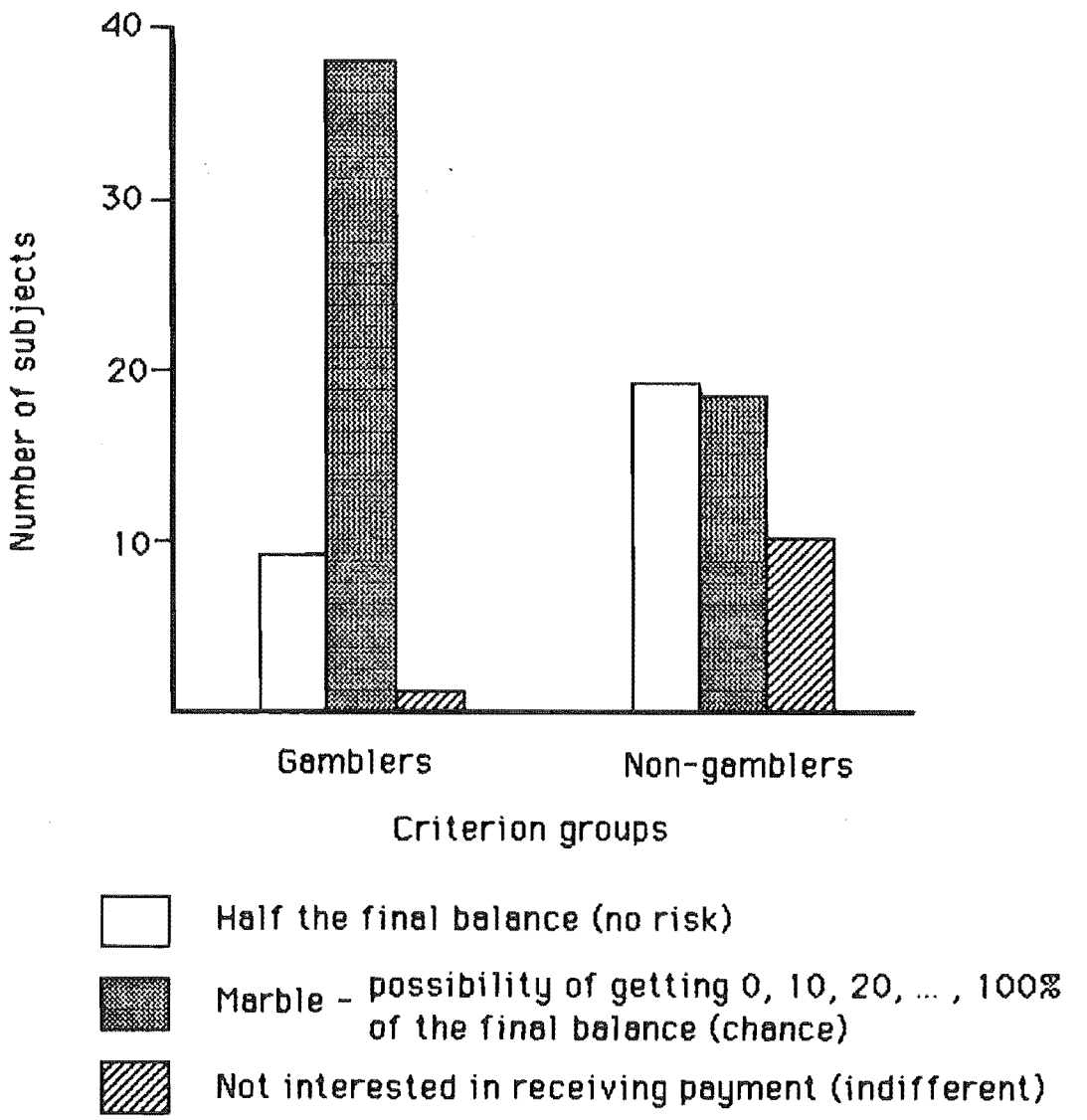
Comparing the mean stakes of gamblers and non-gamblers with their estimates for winning and prediction, gamblers appear reasonably consistent, that is, the peaks and troughs of the mean stakes correspond fairly well to mean estimates. There is, however, a great discrepancy between mean stakes chosen by non-gamblers and their mean estimates for winning and prediction. The most striking examples include Trials 4, 8, 17 and 26. In Trial 26, the decrease in mean estimates were disproportionally greater than the decrease in mean stakes whereas in Trials 4, 8 and 17, the mean stakes varied in the opposite direction to that of the change in both the mean estimates.

3. Choice of payment and skill versus chance.

At the conclusion of the experiment, subjects were given a choice of keeping half their balance from the gambling session or drawing a marble to determine the payment for their participation. Twelve subjects indicated that they did not want any payment. These subjects were put into a third

group apart from those who chose half the balance or those who took a chance with the draw. A chi square analysis showed that there was a significant difference between gamblers and non-gamblers in the choice of payment or non-payment, chi square = 19.0, df = 2, p = 0.0001 (output in Appendix 37). The choices are more clearly represented in Figure 16.

Fig. 16. The number of subjects choosing each form of payment.



Non-gamblers did not show any preference whereas about 4 times the number of gamblers preferred the more uncertain (risky) mode of payment over the fixed 50 percent of the balance. It is also interesting to note that there were many more non-gamblers compared to gamblers who were not interested in any form of payment for their participation.

In the post-experimental questionnaire, subjects were asked whether the gambling game mainly involved skill or chance determination. Gamblers (mean rating = 2.7) perceived that significantly more skill was involved than did non-gamblers (mean rating = 2.1) where 1 denotes pure chance and 7 denotes pure skill, $F(1,74) = 6.5$, $p = 0.013$. There was also an AROUSAL effect in the perception of skill or chance involvement in the game, $F(2,74) = 3.4$, $p = 0.038$ (output in Appendix 38). In the non-arousal condition, subjects perceived more skill involvement (mean rating = 2.9) than the two arousal conditions in which subjects similarly rated that more chance was involved (mean rating in both the exercise- and video-arousal = 2.2).

However, when asked to select a gambling game with varying combinations of skill and chance determination, no difference between gamblers and non-gamblers was evident. Similarly, there was no difference between gamblers (mean = 2.0) and non-gamblers (mean = 1.7) in rating the amount of skill involved in correctly predicting the outcome of a coin-toss (output in Appendix 39). Both group ascribed that the correct prediction as more of a chance event.

Gamblers were significantly different from non-gamblers in their probability preference even when all the choices have an expected value of .3, $F(1,94) = 5.3$, $p = 0.024$ (output in Appendix 40). Gamblers preferred the chance of

winning about 71 cents with a probability of .43 whereas non-gamblers opted for a more certain choice of a .58 probability of winning about 51 cents.

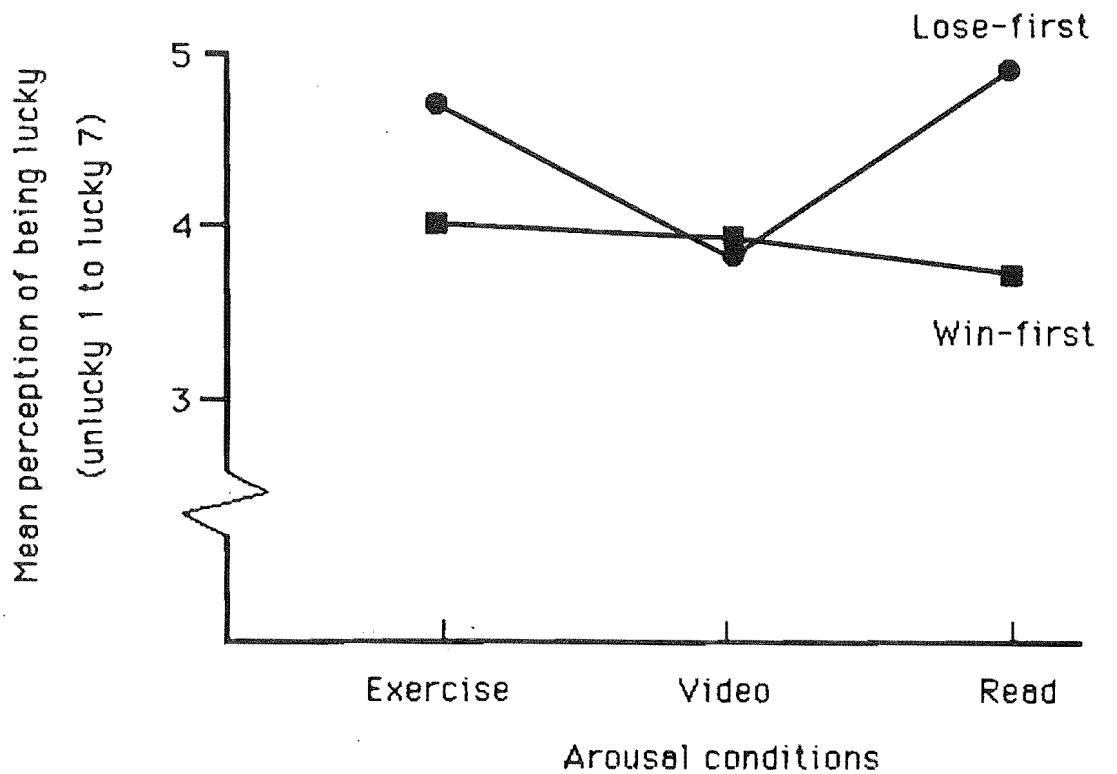
4. Luck

Only a small number of either gamblers or non-gamblers keep a lucky item in their posession. Neither was there any difference in the degree of superstition rating between the two groups (gambler = 2.8, non-gambler = 2.4). However, when it comes to a belief in luck, gamblers (mean rating = 4.0) made significantly higher ratings than non-gamblers (mean rating = 2.9), on a 7-point scale, $F(1,94) = 11.6$, $p = 0.001$ (output in Appendix 41).

Subjects also rated whether they were lucky or unlucky during the gambling session. The rating of luck showed a significant WILO effect, $F(1,74) = 8.8$, $p = 0.004$ (output in Appendix 42). Subjects who experienced the better payoff schedule in the second half of the experiment rated themselves more lucky (mean rating = 4.5) than those who experienced the better payoff sequence first (mean rating = 3.9). There was also a significant WILO by AROUSAL interaction in the rating of luck during the gambling session $F(2,74) = 3.8$, $p = 0.028$. This interaction is illustrated in Figure 17.

In the win-first condition, the arousal manipulations did not seem to have any effect on the ratings, clustering around 4 which constituted the neutral position of a 7-point scale. However, not having any arousal or exercise-arousal in the lose-first condition increased the rating of having luck during the game while video-arousal remained unchanged by the manipulation of payoff history.

Fig. 17. The effect of arousal and reinforcement history on subjects' perception of being lucky or unlucky during game.



Gamblers (mean rating = 4.0) gave significantly more optimistic judgements than non-gamblers (mean rating = 3.1) when asked to evaluate their chances of winning a game they were going to play, $F(1,94) = 11.9$, $p = 0.001$ (output in Appendix 43).

Further analyses examined other possible contributions for the observed differences between the criterion groups. The was no difference in the perception of a major contributing factor to their overall success or failure in the gambling session between gamblers and non-gamblers (see Table 13).

Table 13. Responses to the question: What do you think is the most important factor contributing to your overall win or loss?

	Chance	Luck	Skill	Knowledge	Others
Gamblers	28	7	3	5	5
Non-gamblers	32	7	1	6	2

Judgements of fairness of the game was also very similar between gamblers and non-gamblers (see Table 14).

Table 14. Responses to the question: Do you think the game was fair (not rigged)?

	Yes	Could be	No	Probably not	Don't know
Gamblers	18	18	3	7	2
Non-gamblers	19	17	5	3	4

However, significantly more gamblers than non-gamblers indicated that there were cues which influenced their betting behaviour, chi square = 7.8, df = 1, p = 0.005. Table 15 below gives a breakdown of the variables that affect the subjects' betting.

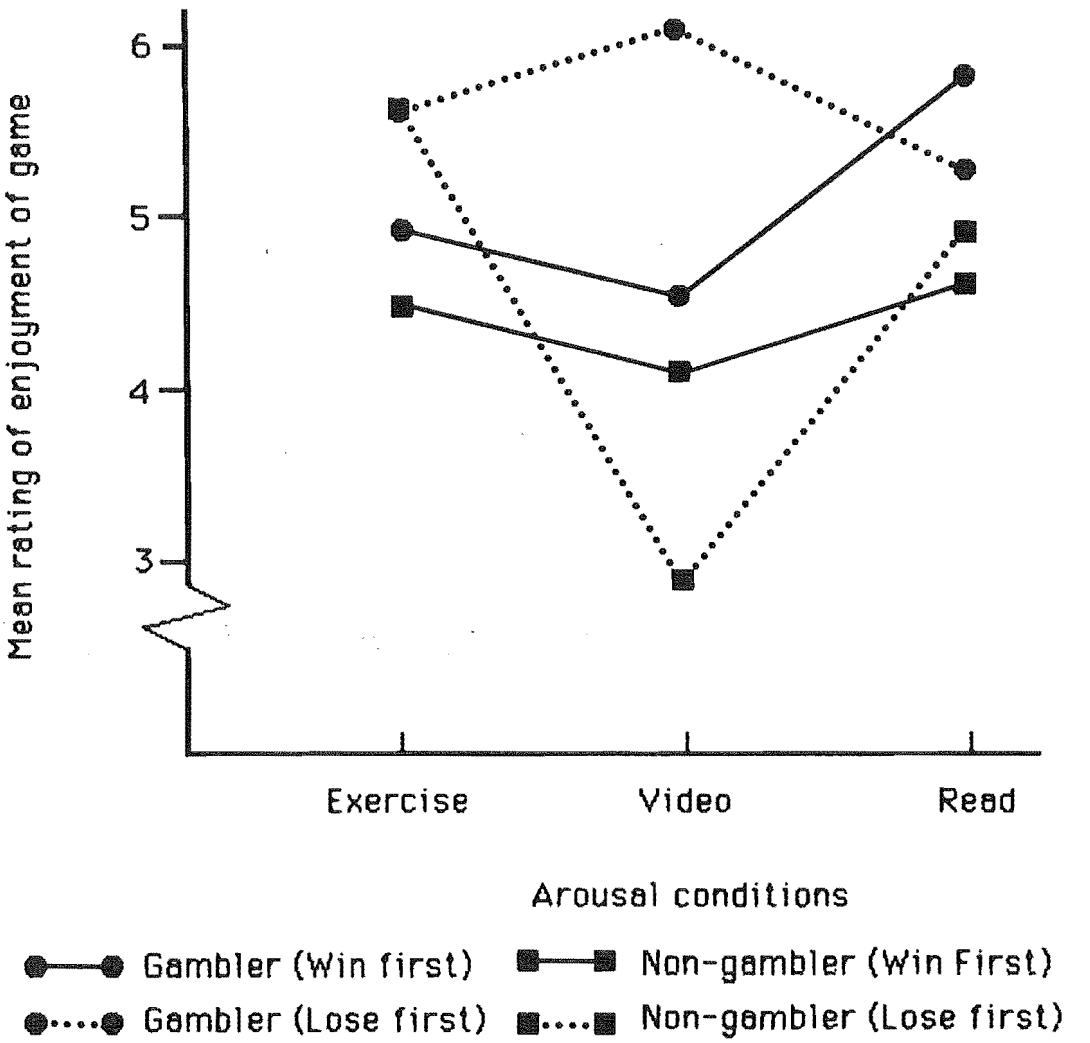
Table 15. Breakdown of the responses to the question: Were there any cues which may have influenced the way you bet?

	Gamblers	Non-gamblers
1. Enjoyment	1	0
2. Beeps	1	0
3. Feeling good	1	0
4. Chance of winning	1	1
5. Boredom	0	1
6. Money (stake size and money in hand	23	11
7. Occurrences of dice numbers	31	16
8. Knowledge of odds or other forms of gambling	2	3

From Table 15 it is clear that money and dice numbers were the most salient factors influencing betting behaviour. Moreover, these were specified twice as often by gamblers than non-gamblers.

Both gamblers (mean rating = 5.3) and non-gamblers (mean rating = 4.4) rated the game as enjoyable on a 7-point scale (output in Appendix 44). This difference in ratings was significant with gamblers enjoying the game more, $F(1,74) = 9.2$, $p = 0.003$. A significant 3-way interaction of GAM by WILO by AROUSAL was present, $F(2,74) = 3.6$, $p = 0.032$. This interaction is shown in Figure 18 below.

Fig. 18. The effect of arousal and reinforcement history on the rating of enjoyment of the game by gamblers and non-gamblers.



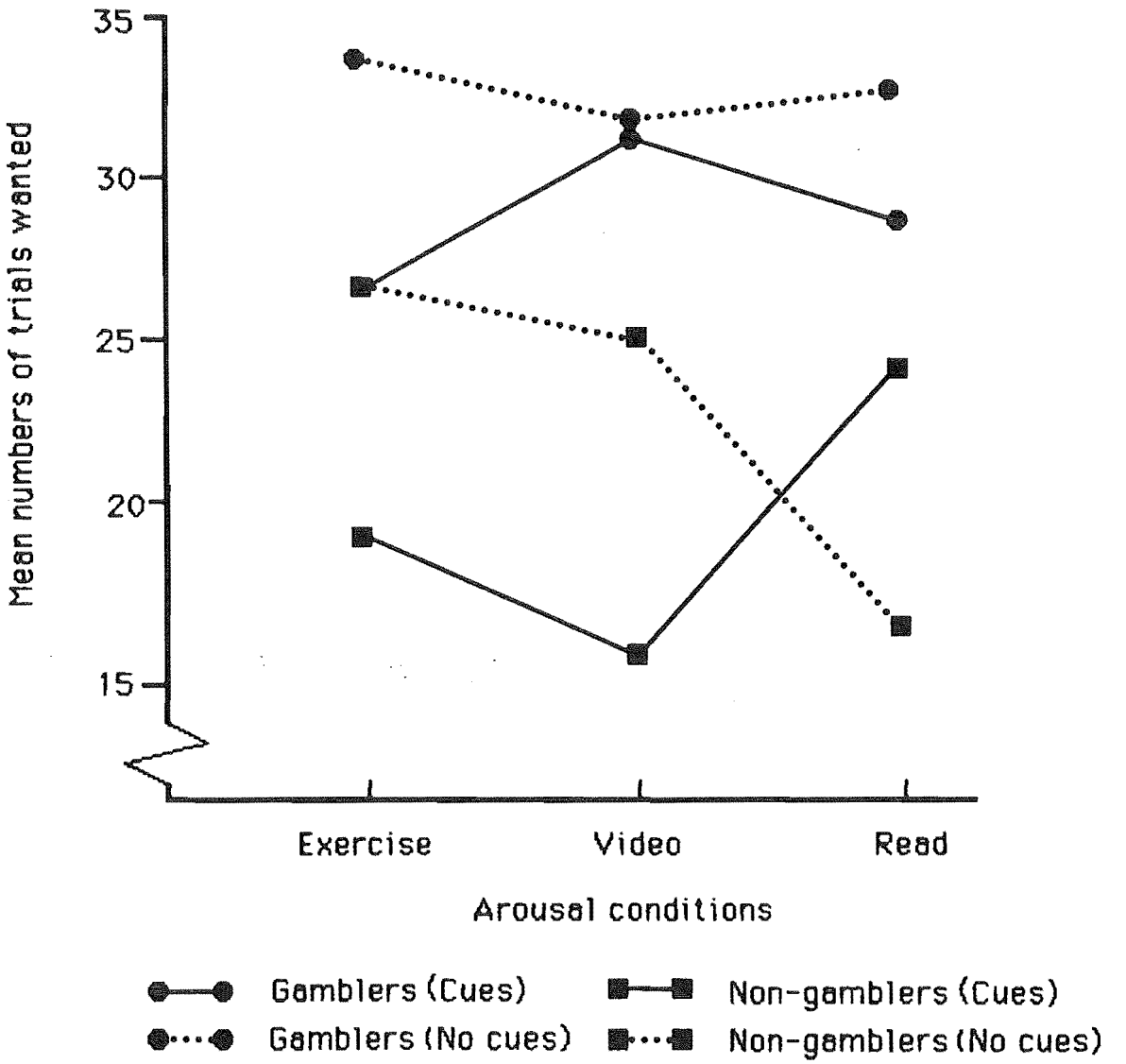
The major effect appear to be the video-arousal under the different payoff schedules. Gamblers were fairly consistent in their ratings throughout the different conditions but video-arousal in the lose-first condition lowered the rating of enjoyment for non-gamblers towards the lower end of the enjoyment scale. Another feature of the interaction is that gamblers appeared to enjoy the game more in the lose-first condition compared to non-gamblers indicating that they were susceptible to the more frequent

gains encountered in the second half of the experiment when rating the game.

The number of gambles wanted was measured by the number of positive responses to the question, "If it were possible, would you like to stop now?" In the analysis the criterion for a definite desire to quit gambling was 3 consequtive affirmative replies. The total number of gambles wanted ranged from 15 to 35 since the first 15 were mandatory, at least, from the subjects' view-point. As expected, gamblers wanted significantly more gambles than non-gamblers, $F(1,74) = 29.8$, $p = 0.001$ (output see Appendix 45). A significant GCUE effect was evident, $F(1,74) = 5.2$, $p = 0.025$. Surprisingly, fewer gambles were desired in the presence of cues (mean number = 23.7) than where cues were absent (mean number = 27.6). There was also a significant 3-way interaction of GAM by GCUE by AROUSAL, $F(2,74) = 3.6$, $p = 0.033$. This interaction is illustrated by Figure 19 below.

The most conspicuous feature in the interaction is the decrease in the number of gambles wanted by the non-gamblers in the presence of cues while at the same time the desire to gamble was decreased in the absence of cues. Overall though, cues lower the desire to gamble under both the arousal conditions. Gamblers wanted more gambles than non-gamblers in either the cues or no cues condition and were only affected slightly by the cues.

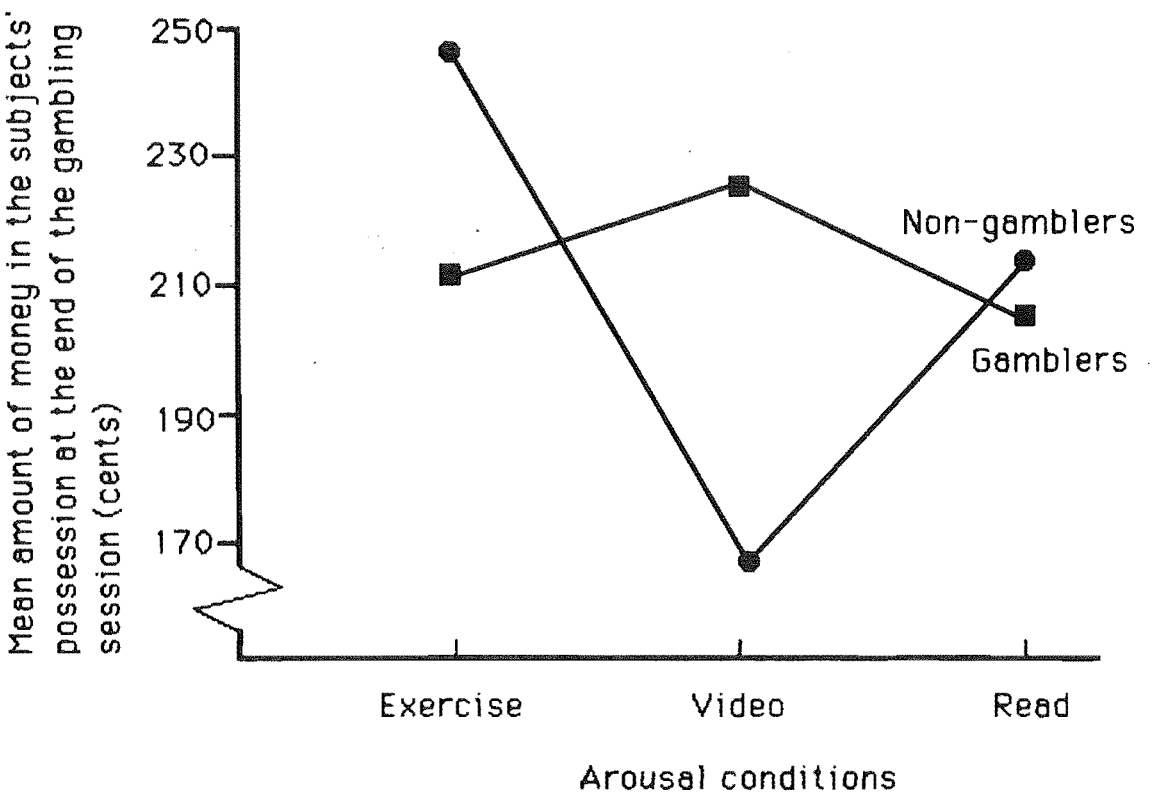
Fig. 19. The effect of arousal and gambling cues on the number of trials wanted by gamblers and non-gamblers.



Finally, the amount of money that was in the subjects' possession at the end of the 30 trials was analysed to give an indication as to whether the available balance had any influence on the subjects' decisions in betting, desire to gamble and success at gambling.

There were two significant 2-way interactions (output see Appendix 46). In the GAM by AROUSAL interaction, non-gamblers appeared to be quite affected by the arousal manipulations, $F(2,74) = 5.4$, $p = 0.007$, being quite successful in the exercise-arousal condition but did very poorly in the video-arousal condition as shown by Figure 20.

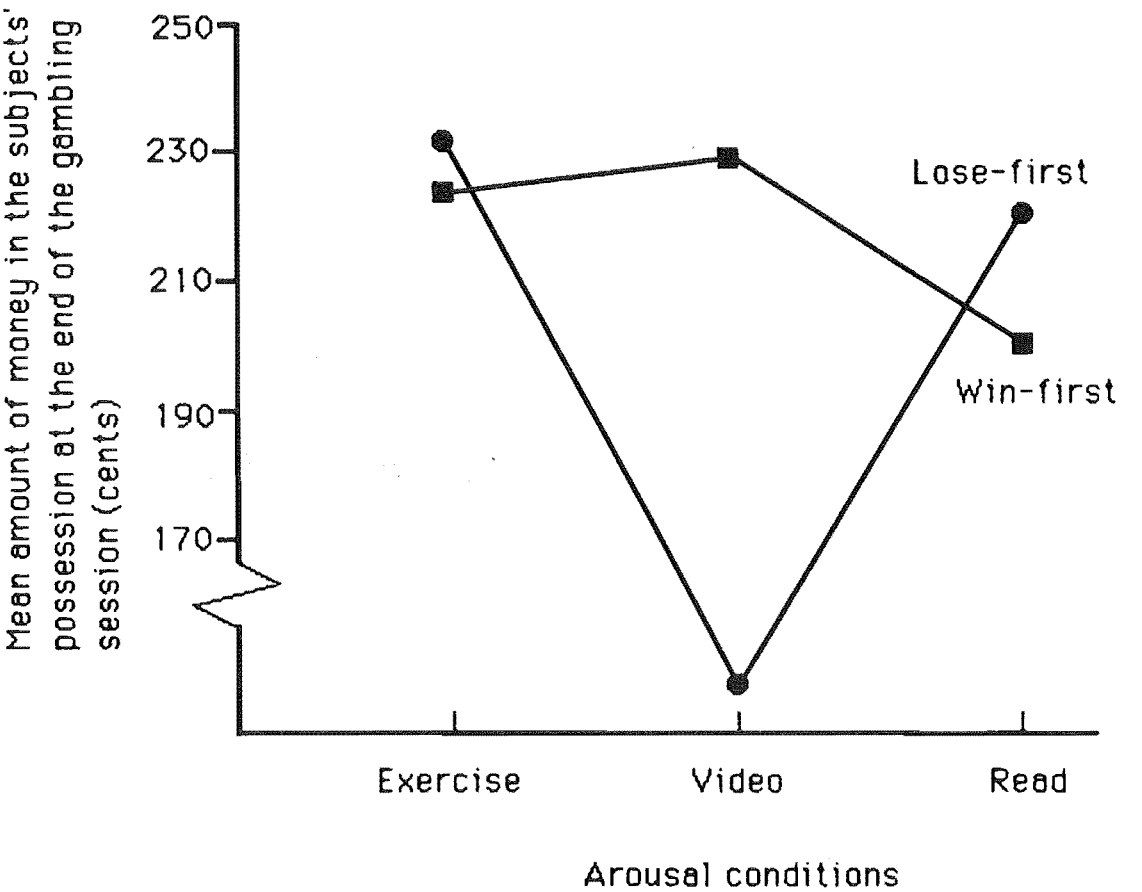
Fig. 20. The effect of arousal on gamblers and non-gamblers in terms of their success during the gambling session.



Gamblers, on the other hand, were relatively unaffected by the arousal manipulations and performed at a level equivalent to non-gamblers in the non-arousal condition.

The second significant interaction was one of WILO by AROUSAL, $F(2,74) = 4.5$, $p = 0.015$, illustrated in Figure 21 below.

Fig. 21. The effect of arousal and reinforcement on the subjects in terms of the success in the gambling session.



There was again a striking video-arousal effect. The video-arousal effect combined with having few payoffs earlier in the session produced a very poor performance. Other manipulations did not appear to have any pronounced effect on the success in gambling.

Discussion

The results obtained in the analyses show that there were quite a number of significant differences between social gamblers and non-gamblers and that the experimental manipulations were effective in altering the behaviour of the subjects in the gambling session, although not all in the direction expected.

1. Betting

The results clearly indicate that the differences in the amount of money staked in the 30 trials were very much affected by the presence of gambling cues. When gambling cues were present social gamblers placed higher stakes while at the same time these cues prompted non-gamblers to lower their stakes. The effects of gambling cues might be to produce a more enjoyable, entertaining and exciting atmosphere which was conducive to gambling thus inducing keener participation in the form of greater risk-taking. The lowering of the stakes of non-gamblers in the presence of cues could be explained in terms of the unfamiliarity of the stimuli which probably served to highlight losses and the aversiveness of the atmosphere associated with the losses. Along this line of thinking, social gamblers may be more tolerant towards other aversive non-gambling stimuli compared to non-gamblers. This may help explain results such as McGlothlin's (1954) who found his gambling subjects to be better adjusted than the norms of the Bell Adjustment Inventory. This could be easily tested by simply confronting both groups with aversive stimuli without any gambling content, under those circumstances, social gamblers would be

expected to tolerate the aversiveness better than non-gamblers.

The overall pattern of gambling indicated that social gamblers increased their mean stakes after a loss and decrease their mean stakes after a win whereas non-gamblers increased their mean stakes following wins and decrease their stakes following losses. In other words, social gamblers were more influenced by the negative recency effect and non-gamblers the positive recency effect although non-gamblers exhibit more variability in their decisions. This negative recency effect was most pronounced when more than one win or loss was encountered consecutively showing more fallacious reasoning by social gamblers.

Typical usage of the term `gambler's fallacy' is exemplified by the behaviour of gamblers in a gambling situation such as the one in the present experiment. Depending on the context it is being used, it has also been referred to as the `Monte Carlo fallacy' or the `fallacy of the maturity of chances'. Tversky & Kahneman (1974) argued that in a genuine game of chance no system of prediction is possible which, in part, is what is meant by `chance'. In gambler's fallacy clear cut information about the probability of an event is not taken into account because people believe that chance is a self-correcting process, such that deviation in one direction will necessarily be followed by a deviation in the opposite direction to restore equilibrium. In fact, deviations are not `corrected' as such but as a chance process unfolds, it is merely diluted.

The influence of both positive and negative recency effects, shown by the gambling decisions of non-gamblers and social gamblers respectively, are really examples of gambling

fallacies. In a chance situation it is equally probable to expect another loss to follow a previous win or loss and another win to follow a previous win or loss. From this reasoning and the nature of chance events it would mean that the most logical system of betting is a random one without taking into consideration the outcome of the previous bet. Although the two observed trends represent spurious reasoning they, nevertheless, provide guidelines for decision-making in a chance situation.

In the discussion above, non-gamblers were described as a little more logical, showing greater variability in their betting decisions. The most interesting observation, however, is that not only social gamblers but also non-gamblers as well exhibited gambling fallacies in their decisions and that these fallacies are fairly consistent within the gambler and non-gambler group. Future research should take into account the differential recency effects in sequential gambling especially when the subjects used include both gamblers and non-gamblers.

Cohen (1970) demonstrated that winning and losing have a differential effect on the next bet that is placed. There was a tendency for his subjects to increase the stake after winning and to decrease it after losing although about half the stakes placed were unchanged after either winning or losing. The present data show that the variations in the mean stake placed is more a function of the characteristic of the group, that is, gambler or non-gambler, in a manner described above. In addition, a number of other factors appear to be influential as well in determining the amount bet. Other investigators have shown that an individual's choices among gambles are independent of the amount of money

previously won or lost (Slovic, 1962; Slovic et al., 1965; Lichtenstein, 1965; Greenberg & Weiner, 1966), but an alternative component of reinforcement history, the ratio of the number of wins to the number of losses, has significant effects on risk-taking behaviour (Greenberg & Weiner, 1966; Morgan, 1983). Subjects who have experienced either very high or low ratios of reinforcement on previous trials preferred high-risk gambles while those whose number of wins equalled their number of losses tend to select more conservative bets as measured by the probability and the amount to win.

The effect of having a win compared to having a loss in the previous outcome was to decrease the amount of money staked when subjects have been aroused, encountered lower than 50 percent payoffs, and when the gambling atmosphere was dull. On closer inspection, a run of 3 losses following a double win appear to have an inexplicable effect on both social gamblers and non-gamblers introducing many variations in the betting under the various influences. All the analyses showed that cues increased risking in social gamblers and decrease risking in non-gamblers but in the bets preceded by runs of 1, 2, and 3 wins and losses the major difference between social gamblers and non-gamblers was highlighted after subjects have experienced a greater than 50 percent payoff ratio with cues present. Winning and runs of 2 or 3 wins encouraged higher risk-taking in social gamblers following a history of better than average number of payoffs while non-gamblers decreased the size of their bets under similar conditions. Furthermore, social gamblers took even more risks following two indicators of good fortune, an immediate one and another which was spread over a longer

period of 15 trials and, similarly, for non-gamblers following immediate wins a good reinforcement history inspired greater risk-taking. Immediate losses only exacerbated the effect of a poor reinforcement history by increasing risking in social gamblers and decreasing risking in non-gamblers again, showing consistent negative and positive recency effecs in social gamblers and non-gamblers respectively. This is further support for the contention that there is an interaction between the immediate and the longer term ratios of wins and losses in determining the size of the next bet. The other two important determinants of stake size were the presence or absence of gambling cues and the gambling status of the subjects - gamblers or non-gamblers. Overall, having a favourable reinforcement history stimulated higher risk-taking and an unfavourable reinforcement history reduced the risk taken for all subjects combined. Another interesting observation is that the effect of having a run of 2 wins or losses cancelled out the effect of individual wins or losses. When runs of 3 wins or losses were encountered the effect is similar to that following an outcome of 1 win or loss but with greater potency. It would be interesting to see how runs of 4, 5, 6 or more wins or losses effect the risk subjects will take. Extrapolating from the present results after a run of 4 wins/losses the risk taken will be like that after a run of two wins/losses and for a run of 5 wins/losses the result will be similar to that of 3 wins/losses but with an even greater influence either way. But, the results of Myers & Fort (1963) suggest that the influence of a run of wins or losses will peak after 3 consecutive similar outcomes have occurred although according to Anderson & Whalen (1960) th length of the run

before alternation occurs has yet to be determined. In any case, it is fairly clear that it was the number of wins and losses encountered and the vicinity of these outcomes, rather than the absolute amount of money won or lost, that was critical in inducing the changes in the size of the subsequent stakes. This observation supports Morgan's (1983) results which showed that the number of initial wins is a seemingly more important variable than the actual monetary holdings in determining the risk preference.

2. The subjective estimates of the chances of winning and making correct predictions.

Prior to the gambling session social gamblers were a bit unsure of their chances of winning and non-gamblers were relatively more pessimistic. However, during the gambling session social gamblers expressed heightened optimism in their gambling decisions compared to non-gamblers in terms of the amount staked, ratings of the chances of winning and making correct predictions. As mentioned earlier, the optimism in social gamblers may be a function of an over-representation of success events than failure events encoded in their memory. One can argue that bets higher than the overall mean bet chosen by social gamblers reflect their risk-taking tendency while the ratings of the chances of winning and making correct predictions really reflect optimism or pessimism and cannot be explained by a risk-taking propensity. A plausible explanation was offered by Greenberg & Weiner (1966) who observed a general trend among subjects whose subjective probabilities were biased. Further support for the contention that gamblers evaluate subjective probabilities of winning in a biased manner came

from Gilovich (1983). He speculated that subjects who are psychologically invested in being effective bettors, people who actually gamble in the real world, will be more biased in their evaluation of outcomes as compared to non-gamblers. This is derived from the observation that `fluke' events are apparently siezed upon by losing subjects to explain away their loss; winning subjects, on the other hand, are unaffected by these events and this predicted bias is found only for those subjects for whom it is important to be an effective bettor.

In the present experiment this persistent optimism of social gamblers relative to non-gamblers gradually decreased over the gambling session. Non-gamblers appear to be more suseptible to the outcomes of their previous two or three gambles in terms of the rating measures which again manifest the significance of the positive recency effect. Non-gamblers and social gamblers lowered their ratings subsequent to a run of poor returns but non-gamblers were particularly sensitive, exhibiting a sharp decrease. This provides further evidence that the same gambling outcome can have different effects on gamblers and non-gamblers. It is also interesting to note that social gamblers were nearly always subjectively more confident in winning than in making a correct choice. The same was true of non-gamblers in the good reinforcement half of the session but they were surprisingly similar in their ratings of both measures in the poor reinforcement half. The two sets of ratings were also comparatively more equivalent for social gamblers in the poorer payoff half of the experiment than the better payoff half. A possible explanation is that in times of adversity closer attention to the various parameters of gambling is

required resulting in closer matching of both subjective measures. Objectively, these measures should be identical. For example, a 60 percent chance of choosing the right number will yield a 60 percent chance of winning the bet. One possible reason for the discrepancy between the two measures is that the time lapsed between the first and second subjective measures was long enough to allow the subjects to reconsider their decisions. Since the task was basically one of chance orientation further deliberation would increase the uncertainty of the situation resulting in the lowering of the second subjective judgement in each trial. The similarity of the two measurements in the poor reinforcement section is interesting but difficult to interpret. It is suggested that perhaps non-gamblers exhibit greater rationality under adverse conditions, not allowing extra deliberation to distract them from adhering to their original subjective expectation of winning while at the same time consistently under the influence of the positive recency effect.

Another interesting observation is that the mean subjective estimates and the mean stakes placed did not appear to correspond to each other as one would expect. It is a reasonable strategy to place a high stake when one is confident of winning and a low stake when one feels likely to lose. In this respect social gamblers were relatively rational whereas bets made by non-gamblers were highly discrepant with their subjective estimates of winning and making correct predictions. The independence of one set of decisions to the other indicates that perhaps the failure of non-gamblers to realise the relationship between the gambling decisions may be due to their inexperience in gambling.

3. Probability, skill/ chance preference, enjoyment of the game and the belief in luck.

In terms of a certain or uncertain payment social gamblers clearly preferred to take a chance for a larger or smaller payment whereas non-gamblers were indifferent to the choices. There are several possible reasons for this observed difference:

1. Gamblers took more risky alternatives as a habit;
2. Gamblers selected drawing the marble simply for the excitement of an uncertain event;
3. Gamblers saw the chance event as a challenge, also as an opportunity to beat the system and,
4. Gamblers hoped to receive more than just half of the balance at the end of the session, that is, valued money more than non-gamblers.

Only one gambler was not interested in any form of payment at all compared to 11 non-gamblers. This observation provided some indirect support for the proposed explanations. These results are also in line with research suggesting that gamblers may have biased evaluation of probabilities (Gilovich, 1983). Social gamblers rated that more skill was involved in the game than non-gamblers. This could be due to the perception of a skill component in a chance event. The ensuing bias would then allow social gamblers to manipulate their gambling behaviour in an attempt to improve their chances of success. Moreover, gamblers may have over-estimated their chances of success because they have anticipated them and enhanced their sense of control over the outcome (Langer, 1976). As suggested earlier, gamblers may have more success events encoded in memory thus giving them an illusion of a greater likelihood of winning. Phillips

(1972) investigating the probability preferences of gamblers and non-gamblers obtained results which showed that gamblers opted for the highest utility choices available with the accompanying low probability of obtaining them. Gamblers, on the other hand, took both the utilities and probabilities into consideration whereas non-gamblers appeared to be motivated by the payoff alone, thus showing a learning and experience effect. Some of the gamblers in Phillips' sample remarked that their choice was a compromise between two `dislikes' : 1. the infrequency of the reward that went with long shots and, 2. the insufficiency of reward that went with favourites. Phillips' data also indicated that in a situation which, on average, subjects can expect to sustain a loss they will come to regard not losing as a sort of a win. The present data point to a likelihood that the preference for the greater risk measured either by a choice of lower probability of winning or higher stakes placed could be related to the gamblers' higher estimates of success and optimism compared to non-gamblers. Overall, social gamblers took greater risks, chose the more uncertain alternative and have a more biased perception of the skill component in a chance game but there was no evidence to show that social gamblers prefer more chance than skill involvement in a game as compared to non-gamblers.

All these characteristics together with a stronger belief in luck indicate an external orientation in social gamblers, at least in comparison to non-gamblers, although there was no difference in the perception of an important influencing factor contributing to the subjects' wins or losses. Neither was there any difference between the two groups in judging the impartiality of the game. The most

important elements in the game were money that was available to the subjects and the frequency of occurrence of dice numbers. These factors were twice as influential for social gamblers compared to non-gamblers. It was rather surprising that the probability of winning was mentioned only once and the probability of losing not mentioned at all, since these are some of the parameters that were commonly manipulated in the early studies of risk-taking, especially those of Slovic and Lichtenstein and their associates. However, phrasing the question differently might have elicited quite different responses.

Social gamblers, in general, enjoy the game more than non-gamblers under most conditions. The significantly higher number of gambles desired by social gamblers supported the assertion that social gamblers experienced greater enjoyment. Maehr & Videbeck (1968) also found that subjects who were high risk-takers showed an overall higher mean persistence in performing a binary response task. Both greater enjoyment experienced and longer participation in the gambling session by social gamblers were evident even though both social gamblers and non-gamblers were equally successful in the game as indicated by the equivalent balance at the end of the session. This suggests that social gamblers may have reasons other than economic ones for participating in gambling activities. A pure joy of gambling is proposed to be an important motivational factor in the maintenance of gambling behaviour. This proposition has, on the the whole, been neglected in empirical gambling research, probably due largely to the difficulty in quantifying the concept. However, complex mathematical expressions have been formulated to qualify the concept in terms of more familiar

quantities such as expected values and utilities (Lee, 1969; Meginniss, 1976; Fishburn, 1980; Ebanks, 1982). With added research the pure joy of gambling concept could prove to be a useful indicator in discriminating between gamblers and non-gamblers as a selection criterion for research purposes.

Generalisation of this concept to pathological gamblers should be made with caution, if at all, since research suggests that there are several important differences between social and pathological gamblers. Pathological gamblers bet more heavily (Lorenz & Shuttlesworth, 1983) than non-pathological gamblers, quite often down to their last penny before quitting (Livingston, 1974; Gamblers Anonymous, 1974) and in many respects gamble as if they are addicted to gambling. That is to say, pathological gamblers do not gamble for the pleasure, excitement and money but more so to satisfy a craving, avoid withdrawal symptoms (Dickerson, 1977a; Wray & Dickerson, 1981) and if psychoanalysts are to be believed, to dissipate unresolved conflicts. There are a number of references to the unimportance of money to pathological gamblers in their gambling pursuits particularly from psychoanalysts (for example, Bergler, 1958/1970) and the brilliant author Dostoevsky (1949). Money is merely a means to an end, to be used in gambling, to lose in an effort to alleviate guilt feelings (Greenson, 1947; Bergler, 1958/1970), to challenge Fate (Lindner, 1950) and in Dostoevsky's (1949) illustration of a compulsive gambler money is a vehicle to fulfill gambling urges and test Fate. In other words, the pure joy of gambling appears to be unique to the social gambler. If this joy of gambling can be more concretely demonstrated it may lead to a better understanding of the fascinating allurement of the gaming tables and

race-tracks and possibly a revision of some of the risk-taking theories.

4. The influences of gambling cues, reinforcement history and arousal.

Next, the effects of the manipulated variables including gambling cues, reinforcement history and arousal are reviewed. Although there was only one significant gambling cues main effect in any of the analyses of the data, several interactions were significant. Most of those interactions were with the gambler/non-gambler variable which highlight the relevance of gambling cues in the differentiation of social gamblers and non-gamblers. The only significant interaction of the gambling cues not with the gambler/non-gambler variable was with reinforcement history, arousal and outcome. It appears that gambling cues have an influence on the potency of the effects of the outcomes of previous gambles whether they were experienced in a series of trials prior to the gamble in question or when those outcomes immediately preceded the gamble in question. The consistent observation of cues promoting greater risk-taking in social gamblers may be explained by the familiarity of an enjoyable situation for them. Non-gamblers seem to take most risk under conditions where there were no `frills and thrills', suggesting that gambling cues may present more of a distraction rather than an attraction for risk-taking as was the case for social gamblers. Specifically, social gamblers characteristically derive pleasure from a situation where monetary stakes are at risk and this joy of gambling is further enhanced by gambling cues. Non-gamblers not only derive no joy from gambling but the presence of gambling cues

also appears to suppress whatever monetary risk-taking urges they have.

It is important to note that gambling cues were only influential in altering betting behaviour and not the other associated behaviours such as expectations of winning, making the right predictions and perception of luck. This could indicate that gambling cues only have impact on the risk-taking tendency of social gamblers.

There were also a number of significant effects from the manipulation of the reinforcement history and related to that the influence of the previous outcome and runs of those outcomes. In general, following wins, stakes were increased and stakes were lowered following losses. The influence of the previous outcome over the size of the subsequent bet was at the same time biased by the reinforcement history experienced. After experiencing a good reinforcement history, bets were high following wins and low following losses but the experience of a bad reinforcement history had the opposite effect, that is, lowering stakes following wins and increasing stakes following losses. This would suggest that the number of payoffs received over a series of previous gambles also has a critical influence on the size of the subsequent bet than the outcome of the preceding bet. One explanation would be that subjects felt that the ratio of previous wins and losses was a good indicator of the outcomes of future gambles but being highly irrational in terms of the understanding of chance events (Kahneman & Tversky, 1974) and biased by various fallacies (Cohen, 1972) the outcome(s) of the immediate preceding gamble(s) also exert their influence.

Subjects who experienced the good payoff schedule in the second half of the experiment rated themselves more lucky

than those who experienced the good payoff schedule first. This can be explained by a recency effect since the rating was made soon after the end of the last gamble, that is, the immediate successes created an illusion of good luck. This contradicts Ryckman & Rodda's (1971) finding that subjects who had initial success on the task were more confident that they would do well on the remaining problems than subjects who experienced failure initially. However, this difference may not be too critical given the diverse nature of the tasks in the two experiments and more importantly different subjective evaluation that were employed.

Further analyses of the luck ratings showed that the ratings of luck were relatively similar under varying arousal manipulations in the win-first condition but in the lose-first condition the most luck was perceived when there was no arousal followed by a deflated luck rating under exercise arousal and the lowest luck rating occurring under video-arousal. This result indicates that arousal was experienced as an unpleasant stimulus which was associated with a lowering of subjective luck. Another negative consequence of video-arousal was the strikingly poor performance of subjects under this condition after experiencing the poor payoff schedule first. This unusually large loss could possibly explain the low ratings of luck under video-arousal.

In general, the hypothesis that non-gamblers were affected by the outcome of gambles than social gamblers was supported especially in terms of the expectations of winning and making correct predictions but not so evident in betting behaviour. This highlights the importance of the criterion on which a construct - in this instance, the effect of the

outcome of gambles - is being evaluated especially when comparing different studies. It is also relevant to note that both the result of the preceding outcome or a run of similar outcomes and the ratio of the number of wins and losses previously encountered were influential in altering gambling behaviour.

Finally the results of the arousal manipulations are considered. The ratings of enjoyment was affected in the same way as the ratings of luck. Both rating measures were relatively unaffected by arousal manipulations in the win-first condition with the exception that social gamblers enjoyed the game more and non-gamblers enjoyed the game less, than all the other manipulations, under video-arousal in the lose-first condition. These data provide good support for the U-shaped arousal function. The video-arousal raised the arousal level inducing a more pleasant state for social gamblers but the heightened arousal might have exceeded the optimal level for non-gamblers making the situation aversive.

The video-arousal produced both the highest stakes placed and highest expectation of winning followed by exercise-arousal and non-arousal conditions respectively in the main effects. Both arousal conditions also tended to increase the ratings of chance rather than skill involvement in the game, that is, more accurate perception of the chance orientation of the game was made. It seems that arousal, especially video-arousal, promoted accurate judgement of the chance nature of the game. In spite of that higher risk were taken in terms of higher stakes placed and greater optimism were expressed, in terms of the subjective chance of winning as if the individuals were caught up with the spirit of the occasion. This observation is more easily explained by

separating the subjects into the two criterion groups. Social gamblers would be trying to achieve optimal arousal by taking greater risks and the accompanying optimistic expectations of winning may be interpreted to be a means of reassuring themselves, perhaps to maintain a peace of mind. Non-gamblers, on the other hand, being unfamiliar to such increased arousal in a gambling situation became agitated by the additional video-arousal thus biasing their judgements and enhancing their risk-taking due to a disruption of the regulating mechanism as proposed by Cohen (1964). A more detailed explanation was provided by Rule, et al. (1971) who hypothesised that increased emotional arousal may decrease the perception of risk and increase the risk taken in a situation. Descriptions of a person upset by some prior experience suggest that the upsetting experience mutes their sense of danger. This could be due in some cases to the person's attention being focussed on irrelevant cues. It could, however, be due to his/her elevated arousal level and a concomitantly low subjective estimate of the probability of unfavourable consequences.

Video-arousal seemed to have over-aroused the optimally aroused non-gamblers while, on the whole, the additional arousal appeared to have made the game more enjoyable for social gamblers who were hypothesised to be sub-optimally aroused and to have a higher arousal threshold than the average person. For social gamblers the desire was for a continuation of heightened arousal by requesting for more gambles compared to non-gamblers. Gambling cues also seemed to have the effect of overloading the arousal in non-gamblers causing them to markedly reduce the number of gambles wanted.

Social gamblers appeared to be unaffected by arousal in

terms of their successes or failures throughout the gambling session as indicated by the amount of money they had at the end of the session. This could reflect the experience, habituation and increased tolerance in gamblers to the variations in arousal under certain circumstances, especially gambling. On the other hand, non-gamblers performed distinctively poorly under the video-arousal condition. Having a poor payoff schedule coupled with video-arousal also produced an inferior performance but this unfavourable video-arousal effect seemed to be neutralised by the positive win-first condition. This would suggest that having a poor reinforcement history is aversive which interacts with emotional arousal to create an even more unpleasant situation resulting in the poor performance.

The data collected so far seemed to lend some support to the notion of the U-shaped arousal function. Although the experiment was not specifically designed to test the hypothesis of gamblers as under-aroused individuals with a high threshold for arousal some of the data gathered could be used to refine this hypothetical model.

One major problem with the model of the under-aroused gambler is the specification of the optimal level of arousal for the optimally aroused individual. According to the literature this optimal arousal is one which the individual is most efficient in performing the particular task in hand, with different individuals having different optimal levels and different tasks requiring different levels for optimal efficiency. A related problem is the determination of whether the value obtained constitutes a point on the left or right of the optimal level. That is to say it is difficult to determine the level of efficiency the person is

functioning at a point in time, whether an increase in arousal would improve or deterioriate performance.

The last major obstacle in this model is quantifying the arousal produced by each type of stimulus which is encountered in a gambling situation. This would enable an indirect mapping of the position of gamblers and non-gamblers on the arousal curve.

It is wrong to assume that gamblers are chronically under-aroused 24 hours of the day and every day of the year. It is more realistic to suggest that the under-arousal is determined by the levels of hormones in the biological system. The effects of a number of naturally occurring stimulants such as endorphins are only beginning to be understood. It is possible that the monetary risk-taking activities of gamblers are expressions of a search for stimulation, in this instance, one which is internal in nature not unlike the `jogger's high'. Furthermore, as in the case of drug and alcohol use and abuse social and other psychological factors may be involved. Zuckerman (1979a, b) has ably reviewed the optimal level of stimulation and arousal theories and also research on sensation-seeking. He proposed a biological model incorporating hormones and neurotransmitters to account for the sensation-seeking trait. The present model is not very different from that developed by Zuckerman except in the terminology employed. It is argued that although sensation-seeking may be a better term in that it is more specific, it nevertheless implies a `drive' to seek some form of arousal. Currently the concern is more in clarifying the nature of the biological influences of the urge to gamble and the obvious starting point is the well established concept of optimal arousal.

One practical significance of this model is that, if it can be established that gamblers are indeed under-aroused individuals and that gambling is their preferred means of sensation-seeking to attain their optimal level of arousal then, for problematic gamblers, an alternative form of arousal inducing activity may be introduced into their behaviour repertoire, instead of treatment methods such as lengthy psychoanalytic psychotherapy (Boyd & Bolen, 1970) or the discomforting aversion therapy (Barker & Miller, 1968; Goorney, 1968; Seager, 1970).

To sum up, the results of this experiment lend some support to the notion of a U-shaped arousal curve and also the notion of the gambler as an under-aroused individual. However, a lot more work is required to determine the effects of arousal and other gambling related variables such as gambling cues, reinforcement history and gambling experience of the individual and the effects of the interactions of these factors on gambling behaviour. It was shown that the relatively ignored arousal mechanism and gambling cues are influential factors in gambling decisions and should be taken into consideration in future studies.

The final words of this chapter most appropriately come from Cohen (1972) who speculated that,

> The ease with which men everywhere (and increasingly women too, and even children) become punters or gamblers, whatever the nature of the stake or payoff, points, not to an instinct of gambling, but to a `divine discontent' which is distinctly human. Animals do not play poker, nor are they interested in football pools. Yet they are capable of `probability learning', and the fact that intermittent reinforcement renders their habit more

resistant to extinction than continuous reinforcement suggests that arousal mechanisms may possibly be at work in a manner common to man and animal alike; an analogy between the self stimulation of a rat with electrodes implanted in its hypothalamus and a man sitting in front of a one-arm bandit may not be entirely far-fetched.

CHAPTER SIX

AN APPLICATION OF THE REPERTORY GRID TECHNIQUE TO GAMBLING RESEARCH.

Introduction

Since the publication of "The psychology of personal constructs" (Kelly, 1955), an increasing number of studies have used the repertory grid as a research tool. The applications of the grid technique have gathered further impetus with the advent of computers. Slater's INGRID 67 program was one of the first to become accepted and widely available for grid analysis. This was later updated and replaced by the INGRID 72 which is still commonly used.

The repertory grid is used primarily as an exploratory tool in this thesis. Thus, there will be minimal discussion on Kelly's Personal Construct theory although it is acknowledged that Kelly provided the most significant contribution to the development of the repertory grid technique. Bannister and Mair (1968) have noted that grid methods can be employed independently of construct theory. The theory can be formulated without reference to the technique and conversely grids are obtainable without depending on the theory.

Kelly's fundamental postulate is that man's behaviour is directed by the way in which he anticipates events. For Kelly, understanding another man is achieved to the extent that we know how he goes about the task of making sense of his world. The personal construct system of each individual is the set of representations or models of the world he has

developed which has been acquired through social experiences, some pre-verbal, and others verbally transmitted, but not all of it accessible to the individual in terms of self-consciously held concepts. In all cases, this system is to some degree shared with others and to some degree unique to the individual. The personal construct system is not immutably fixed but as with scientists' hypotheses, further experiences may modify it.

The personal construct system is built up of interrelated constructs, each individual construct being concerned with discriminating between elements. An element is defined as anything which can be so compared and contrasted, such as people, situations or concepts. It is important to recognise that words are used to label the poles of the constructs but are themselves not the constructs. Following from Kelly's theory, there are several explicit or implicit features which characterised these constructs. A construct can only be applied to elements which fall within the same class or range of convenience. A distorted picture of an individual's construing will be obtained when elements used are incomparable, such as an inclusion of concepts, situations and people all on the same list. By the same token, only constructs relevant to all the elements should be employed. For example, it makes little sense to construe whether a piece of rock is kind-unkind or clever-stupid.

Construing, which Kelly regarded as a typical form of thought, is the recognition of a contrast between two sets of things. For example, a man construes his acquaintances when he forms the opinion that some are stupid and others are clever. The construct stupid-clever would be senseless to him if it does not provide any distinction between people he

has to mix with. Even though only one of its opposite poles is defined a construct is implicitly bipolar. The term used to define it explicitly is described in that case as the emergent pole and the contrast left undefined as its latent pole.

Another important feature of constructs is that they are arranged in a hierarchical order. One construct may subsume another as one of its elements, in which case its ordinal relationship is known as superordinal and the relationship of the other becomes subordinal. Thus, an individual structures his constructs by concretely arranging them into hierarchies and by abstracting them further. Since man is constantly construing events and processes around him, and re-evaluating his constructs, superordinacy is then a relative term. A construct is seen as more or less superordinate at different points in time.

A grid may be defined as any form of sorting task which allows for the assessment of relationships between constructs and which yields these primary data in matrix form (Bannister and Mair, 1968). The grid itself records interactions between two sets of functions- a set of operators and a set of operands- named by Kelly (1955) as constructs and elements respectively. Some examples of different elements that hve been used are: feelings (Fransella and Adams, 1966), situations (Watson, 1970), diseases (Orley and Leff, 1972), occupations (Shubsachs, 1975), consequences of situations (Watson, Gunn & Gristwood, 1976), rooms (Honikman, 1976), relationships (Ryle, 1981). This list is by no means exhaustive but illustrates the great versatility which characterises the grid technique. A number of psychologists have regarded the grid and the Semantic Differential as

similar measuring tools in psychological research. There are, however, a number of important differences between the two measurements which make the grid a superior and more appropriate instrument to use in the context of this thesis. Osgood (1962) argued that "meaning is a multi-dimensional space and that a particular word will be represented by a point in this multi-dimensional space." In summary, the Semantic Differential is an instrument which utilises seven-point, bipolar rating scales. This rating scale is itself a special scale since it is derived from an extensive series of factor analytic studies. The instrument allows a cross comparison of the meanings of two different words for one subject, or the meanings of one word for a number of subjects, by enabling the experimenter to sum ratings in terms of three allegedly major dimensions of meaning.

The major difference between grids and the Semantic Differential is that personal construct theory lays great stress on the idea that constructs and construct sub-systems have limited ranges of convenience and that personal construct theory embodies a fairly radical set of assumptions compared to the traditional theories of human psychology. The central characteristic of Semantic Differential is its utilisation, on the basis of factor analytic research, of three major, allegedly orthogonal dimensions. Since they are thought to be independent of each other, they are designed to give maximum dispersion of concepts in the structured semantic space, thereby providing an optimal description of the meaning of concepts thus plotted. The Semantic Differential assumes the generality of meaning in the words used to label the scales and concepts - a strange assumption for a measure of meaning - while the grid asks a question and

attempts an answer (Bannister and Mair, 1968). In grid terms, the Semantic Differential is concerned with the placement of certain specific elements in relation to a number of constructs. The advantage of the grid method is that not only does it allow an examination of the elements in the construct space but also allows an examination of the relationships between constructs in the element space.

A description of the repertory grid technique.

The raw data of a grid consist of an m by n matrix where m is the number of elements and n the number of constructs. The grid denotes the elements in the individual's range of convenience which is usually assumed when the elements are provided. This grid can either be obtained by ranking or grading the elements in terms of the constructs. For example, in the AROUSAL GRID (Appendix 25) the situation that causes most anxiety will get a ranking of 11, the one that elicits the second highest amount of anxiety will get a ranking of 10 and so on with the least anxiety provoking situation being assigned a ranking of 1. The remaining rows are obtained in a similar fashion using different constructs each time. Ranking is not the only method of scaling that can be used, any other method that the informant can manage is permissible. A seven-point scale used in a similar fashion as the Osgood's Semantic Differential (1957) also forms a two-way table of numerical entries which can be treated like a grid. Even a 1 or 0 grading denoting the applicability of the construct to each element in turn will serve the purpose of providing a grid although the nominal properties of its entries restrict the range of analyses available. The advantages and disadvantages of each method

are discussed in Mair and Boyd (1967), Bannister and Mair (1968), Fransella and Bannister (1977), Shaw (1980), Shaw and Gaines (1981) and others.

When factor analysis or principal component analysis is proposed the computations begin with the calculation of a covariance matrix. It may be formed by summing squares and products over the constructs and elements. In experiments with grids interest is not likely to concentrate on one aspect of the data and overlook the other. Besides studying the relationships between particular constructs, the experimenter may want to examine the relationships between particular elements and, most of all, the relationships between functions of one set and the functions of the other. Factor analysis is unsuitable for a few reasons. The fundamental objection to it is the untenable assumption of specific factors. It cannot give all the results required but is limited, at best, to a dubious and incomplete analysis of the correlations between operators or constructs (Slater, 1964).

The grid may be read either by row or column. Each way of reading the array gives the specifications for a multivariate dispersion. The entries in any column form a vector of co-ordinates giving the location of the element in a space with an axis for every construct- C-space for convenience. Likewise the entries in any row form a vector locating the construct in a space where there is an axis for every element, the E-space. Thus, there are two multivariate dispersions corresponding exactly to the array of entries but generally appearing very different from one another geometrically. Since they both represent the same data one may expect to find some relationship between them. Principal

component analysis defines the connection between the two (Slater, 1960; 1977).

It is most common to see grid results represented on a two dimensional diagram in C-space (Ryle, 1975; Slater, 1976). The elements are distributed at different distances in different directions away from their point of equilibrium- the multivariate mean- which has been placed at the origin of the C-space by the operation of centering. The distance of an element from this origin measures the importance of the element in the construct system, sometimes referred to as its salience. The relation between the two dispersions is shown on the plane of the first two components (usually with the horizontal axis for the first and the vertical axis for the second component). The plane is treated as a section of the component space within the C-space, the elements being indicated by points and the constructs by directions.

The points for the elements are found by taking their loadings as co-ordinates. Similarities and differences are indicated by the differences between them. In order to show the relations between constructs a circle with a convenient radius is drawn round this distribution with its centre at the origin, but rectangular boundaries are just as effective and commonly presented in the literature. The loadings of the constructs define the axes crossing it and their opposite poles are shown projecting from the circumference. The axis of a construct will pass through the centre and the point determined by construct loadings as co-ordinates. It is extended to the circumference in both directions to show its positive and negative poles.

In summary, the diagram shows the relationships among and between constructs and elements. The degree of accuracy

of the plane used depends on how much of the variation is absorbed by the roots of the first two components. Three component diagrams can also be mapped by using the polar co-ordinates of the constructs and the projections for the elements to locate their respective positions on the geographical globe. The advantage of a 3-component diagram is that results for all three components can be combined. The circumference of a circle is replaced by the surface of a sphere. The Ingrid 72 program lists their polar co-ordinates to simplify mapping of such results (Slater, 1977).

The relevance of the grid technique in gambling research.

A commonly debated point concerning the grid technique centres on the use of either provided or elicited constructs, adequately discussed in Bannister and Mair (1968) and more recently reviewed by Adams-Webber (1970). There is evidence to suggest that grids using provided constructs can produce meaningful results (Nysteld, Ekehammar & Kuusinen, 1976) and are significantly related to individuals' behaviour (Fransella & Bannister, 1967). In any case, it is theoretically impossible to "supply" constructs since constructs are not verbal labels but are really the discriminations which the subjects make between elements. Thus, all that can be supplied are the verbal labels to which people will attach their own constructs. If the guesses of the experimenter are good and there is close agreement between the verbal labels used `supplied' and `elicited' constructs will not make much difference. On the other hand, unfamiliar supplied verbal labels will produce a marked difference (Fransella & Bannister, 1977). But as constructs

in this study have been selected from a common pool they are not, in any simple sense, either `provided' or `elicited'.

When both the constructs and elements of the grid are in practical terms `supplied' to the subjects the grid can be seen as a special kind of personality questionnaire (Slater, 1970). Duck (1973) suggested that the advantages of the repertory grid over personality tests seem to depend on its emphasis on the more personally relevant items of cognitive structure. In Duck's study, for the grid, the content similarity between generated constructs was recorded (the words used), and in the Californian Psychological Inventory similarity of marks on the test (the numbers scored). Thus, in the latter case, it may have been possible for subjects with different answers to sets of particular questions to achieve a similar score without any great agreement existing between them on the particular items. Duck (1973) also pointed out that any dimensional test of personality relies on the same measuring technique for summarising personality. The other advantages of the grid technique are that it gives the subjects a chance to disclose a lot about themselves in a short time and because of the nature of its construction it is adaptable for use in nearly any situation.

In this study the grid is adapted to investigate the relationships between elements and constructs pertinent to gambling. With the STIMULUS GRID (Appendix 22) additional analyses were carried out especially on the data concerning elements THE PERSON I AM and THE PERSON I WOULD LIKE TO BE, to examine the perceptions of the self and ideal self in terms of the provided constructs. In the AROUSAL GRID an attempt was made to specifically include elements that were gambling related activities along with the associated

emotions as constructs. The choice of elements and constructs were deliberately biased to allow for a more in depth examination of the personal constructions of gamblers. Non-gamblers were included as controls even though it is rare for controls to be used in grid studies due to the potential difficulties in sharing constructs between groups (Bannister & Mair, 1968; Slater, 1976, 1977). However, Watson, Gunn & Gristwood (1976) showed that the grid can usefully be employed in a group situation and indicated the potential of the grid in group research.

It is hypothesised that a number of differences between the constructions of gamblers and non-gamblers will emerge without expectations of any predicted pattern due to the nature of the grid analyses. It is the organisation of the construct-construct and construct-element interrelations which is the fundamental interest in this experiment and the applicability and usefulness of the grid technique are appraised.

Method

Subjects

The subjects completing the STIMULUS GRID consisted of 23 non-gamblers and 13 gamblers who took part in the Stimulus-bound Experiment which was described in Chapter 4. Subjects completing the AROUSAL GRID were made up of 48 non-gamblers and 48 gamblers who participated in the Arousal Experiment described in Chapter 5.

Construction of the grids.

The elements and constructs of the STIMULUS GRID were fully `provided'. Elements were persons who were assumed to be influential in the subjects' lives including four different perceptions of the self. Constructs consisted of character descriptions that were relevant to gamblers and were derived from previous studies including the Personality Study described earlier (see Appendix 22 : STIMULUS GRID).

The elements and constructs were `elicited' for the AROUSAL GRID. Three social, non-pathalogical gamblers (personal acquaintances of the author) were extensively interviewed individually without any rigid structure to gather information pertaining to gambling activity. The most frequently mentioned situations and associated emotions were included in the grid. The resultant grid contained situations or behaviours which are related to gambling as elements and the associated feelings or emotions as constructs (see Appendix 25 : AROUSAL GRID).

In the STIMULUS GRID both poles of the constructs were explicitly identified while only a single term designating the construct is provided in the AROUSAL GRID.

Procedure

Subjects were asked to complete the grid by indicating how the constructs apply to the elements using a 7-point rating scale. It was explained clearly that 1 and 7 were respectively the lowest and highest ratings allowed with the rating of 4 as the indifference point between the two extremes. Subjects were also required to give their impressions without deliberating too long on any one item. They were verbally assured that it was their opinions that were being sought and that there were no right or wrong answers. In both cases nearly all grids were completed between 15 to 25 minutes.

Note 1.

Due to the frequent reference to the terms social gambler the word social is omitted from the text in this section although the characteristics of the gambler refers to the social gambler.

Note 2.

In the Results and other subsequent sections elements will be denoted by capital letters and constructs by an emphasised font to allow easier differentiation between the two components of the grids.

Results

THE STIMULUS GRID

The individual STIMULUS GRIDs of the 13 gamblers and 27 non-gamblers were averaged into two 'consensus' grids representing a typical gambler and non-gambler grid respectively. This was achieved by calculating the mean rating of each cell in the 13 gambler grids taken together and the same procedure was used with the 27 non-gambler grids. The two grids were then analysed using Slater's INGRID 72 program. A principal component analysis was carried out on both the grids of the typical gambler and non-gambler along with the options for obtaining the construct-construct and construct-element interrelationships.

The gambler STIMULUS GRID

The interrelations between the constructs are shown on Table 16 in terms of their correlations and angular distances. For gamblers there was a significant positive correlation between the construct **does not like/ likes to gamble** and **does not believe/ believes in luck** supporting the previous finding that a belief in luck is closely associated with gambling. The pole **believes in luck** was also associated with the pole **likes excitement**. The pole **takes risks** was associated with **likes excitement** and **is optimistic** while the opposite pole **does not take risks** was associated with the poles **tends to worry, has a liberal outlook** and **is not superstitious**.

Table 16. The inter-correlations and angular distances between constructs for the gambler STIMULUS GRID.

CONSTRUCT 1

2	0.63	50.7	3	-0.33	109.6	4	0.61	52.6	5	-0.30	107.2
6	-0.16	99.2	7	0.24	76.3	8	0.40	66.2	9	-0.50	120.1
10	-0.37	111.9	11	0.69	46.5	12	0.15	81.2	13	-0.44	116.3
14	0.32	71.4									

CONSTRUCT 2

3	-0.66	131.2	4	0.91	25.2	5	-0.50	120.0	6	-0.52	121.5
7	0.54	53.5	8	-0.43	92.5	9	-0.35	110.5	10	-0.71	135.3
11	0.51	59.3	12	0.36	68.9	13	-0.84	147.4	14	0.73	42.8

CONSTRUCT 3

4	-0.84	146.8	5	0.71	44.5	6	0.97	15.3	7	-0.40	113.8
8	0.43	64.9	9	0.36	69.0	10	0.97	15.1	11	-0.48	118.6
12	-0.28	106.2	13	0.80	36.6	14	-0.95	161.7			

CONSTRUCT 4

5	-0.58	125.7	6	-0.73	137.1	7	0.62	51.6	8	-0.09	95.1
9	-0.34	110.0	10	-0.91	155.3	11	0.68	47.3	12	0.51	59.3
13	-0.91	155.5	14	0.90	26.4						

CONSTRUCT 5

6	0.61	52.4	7	0.07	85.7	8	0.22	77.4
9	-0.03	91.9	10	0.70	45.5	11	-0.38	112.4
12	-0.28	106.5	13	0.70	46.0	14	-0.67	132.0

CONSTRUCT 6

7	-0.45	117.0	8	0.57	55.3	9	0.38	67.5
10	0.92	22.5	11	-0.38	112.4	12	-0.25	104.6
13	0.68	47.0	14	-0.90	154.2			

CONSTRUCT 7

8	-0.11	96.5	9	-0.56	124.1	10	-0.50	120.4
11	0.42	65.2	12	0.37	68.4	13	-0.36	111.0
14	0.45	63.6						

CONSTRUCT 8

9	0.18	79.9	10	0.34	69.9	11	0.13	82.5
12	-0.17	99.5	13	0.09	84.6	14	-0.36	110.8

CONSTRUCT 9

10	0.31	72.0	11	-0.51	120.8	12	0.13	82.5
13	-0.00	90.1	14	-0.17	100.0			

CONSTRUCT 10

11	-0.60	126.7	12	-0.45	116.9	13	0.85	31.3
14	-0.97	165.9						

CONSTRUCT 11

12	0.48	61.5	13	-0.44	116.1	14	0.45	63.5

CONSTRUCT 12

13	-0.41	114.4	14	0.41	66.1

CONSTRUCT 13

14	-0.92	156.7

Further examination of the interrelationships between the constructs showed a cluster of the following constructs; **is usually calm/ tends to worry, is not concerned about failure/ fears failure, has high/ low self esteem, has a liberal/ conservative outlook, is not/ is superstitious and is pessimistic/ is optimistic.**

Interestingly, the constructs **does not need/ needs achievement, is not easily/ is easily aroused, does things better alone/ better in a group and prefers known/ uncertain outcomes** did not correlate with any of the other constructs. The polar co-ordinates for constructs and projections for elements provided by the INGRID 72 can be used to plot their positions on a 3-dimensional plane (Appendix 47). These constructs when depicted on a composite diagram for the first 3 major components (accounting for 86.5 % of the total variance) showed the dispersion of the construct and element positions on the 3-dimensional geographical globe (Figure 22). This gives a convenient representation of the interrelationships between the constructs and elements but it is difficult to indicate the third dimension, that is, the distance of the points away from the origin (A program for projecting a 3-dimensional sphere onto a 2-dimensional surface using NCAR on the B6900 is given in Appendix 56 - courtesy of R. G. Ritchie).

From the component loadings of both the elements and constructs (Appendix 48) it is possible to obtain the emergent poles of the important constructs and elements.

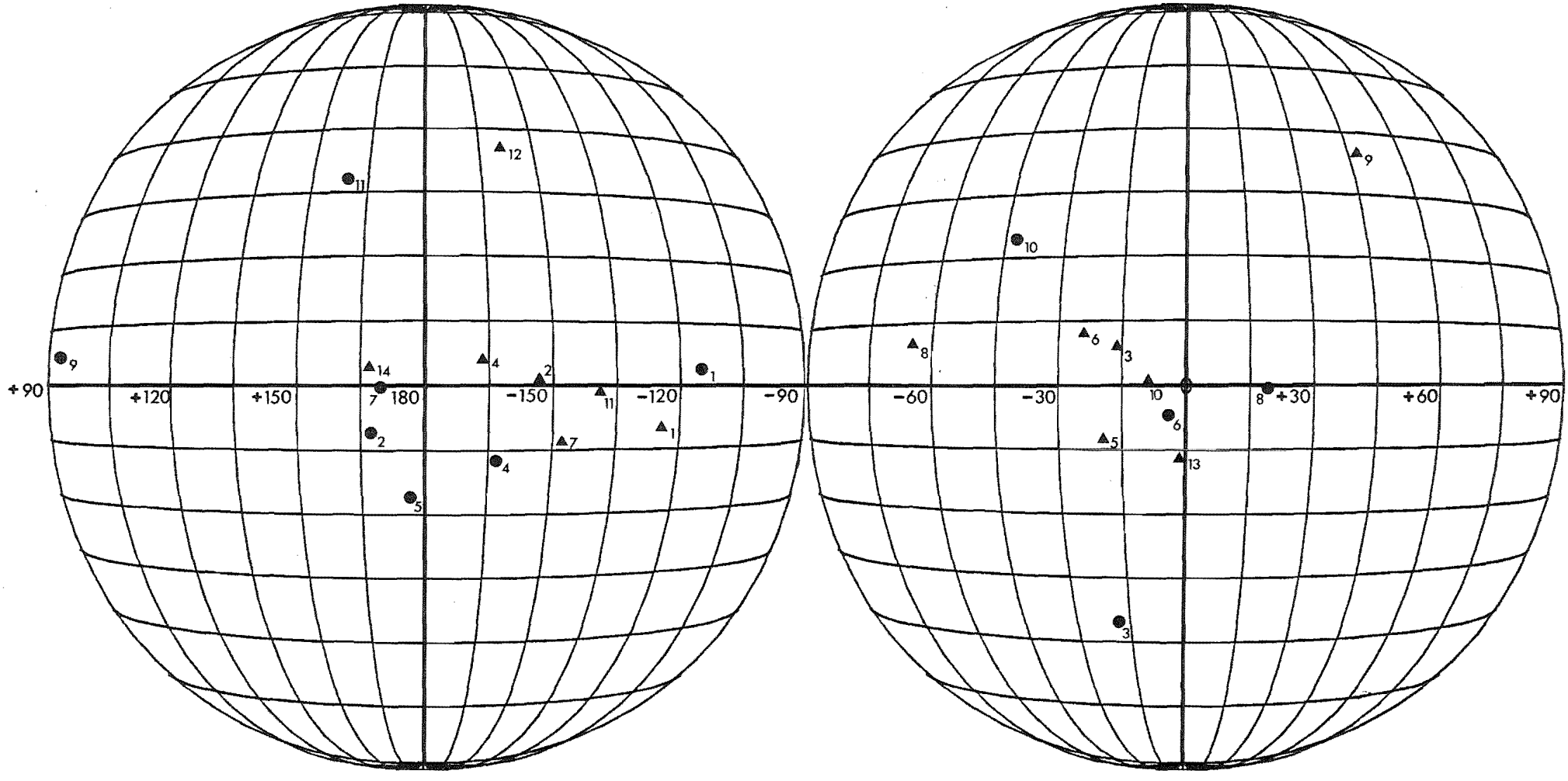


Fig. 22. Composite diagram for components 1, 2 and 3 for the gamblers' STIMULUS GRID.

The first component, which accounts for 67.8 % of the variance, is explained by the following constructs and elements and their contrasts.

positive pole	negative pole
elements	
6 the person I dislike most	2 the person I would like to be
8 the person who usually upsets me	4 the person I will be in 10 years time
	5 the person I admire most
	7 the person I like most
	11 the person whose company I enjoy
constructs	
3 is usually calm/ tends to worry	2 does not take/ takes risks
5 is not concerned about/ fears failure	4 does not like/ likes excitement
6 has high/ low self-esteem	14 is pessimistic/ is optimistic
10 has a liberal/ conservative outlook	11 does not believe/ believes in luck
13 is not/ is superstitious	9 does things better alone/ better in a group

The second component, which accounts for 11 % of the variance, consists mainly of the element THE PERSON WHOM I FIND COMFORTING. This is contrasted by the element THE PERSON I AM, which is associated with the construct **does not like/ likes to gamble.** Finally, the third component, accounting for 8 % of the variance, comprises mainly the

elements THE PERSON WHOM I FIND THREATENING and THE PERSON WHOSE COMPANY I ENJOY with the associated constructs does things better alone/ better in a group and prefers known/ uncertain outcomes.

The non-gambler STIMULUS GRID

The `average' non-gambler grid was similarly analysed by using the INGRID 72 program. Correlations and angular distances between constructs are shown in Table 17. For non-gamblers the construct pole likes gambling is associated with construct poles has a conservative outlook and is superstitious while at the same time the opposite pole does not like to gamble is associated with does not like excitement. The construct pole takes risks is correlated with the construct poles does things better in a group and prefers uncertain outcomes. The contrast pole, does not take risks is associated with is not concerned about failure and has high self-esteem. The pole believes in luck is positively correlated with the constructs poles; fears failure, has low self-esteem, needs achievement and has a conservative outlook but does not believe in luck is associated with is pessimistic. A very similar grouping of correlated constructs is again evident for non-gamblers. This cluster of constructs includes; is usually calm/ tends to worry, is not concerned about/ fears failure, does not need/ needs achievement, is not easily/ is easily aroused, has a liberal/ conservative outlook, is not/ is superstitious, and is pessimistic/ is optimistic.

Table 17. The inter-correlations and angular distances between constructs for the non-gambler STIMULUS GRID.

CONSTRUCT 1

2	0.45	63.4	3	0.60	53.6	4	-0.72	135.6	5	0.10	84.3
6	-0.22	102.9	7	0.65	49.6	8	0.57	55.3	9	0.74	42.3
10	0.70	45.8	11	0.34	70.2	12	0.26	75.1	13	0.86	31.1
14	-0.57	125.0									

CONSTRUCT 2

3	-0.33	108.9	4	-0.00	90.0	5	-0.68	133.2	6	-0.77	140.3
7	-0.15	98.4	8	-0.34	110.1	9	0.69	46.8	10	-0.24	103.6
11	-0.28	106.5	12	0.84	33.1	13	0.06	86.6	14	0.24	76.0

CONSTRUCT 3

4	-0.60	126.8	5	0.78	38.8	6	0.52	58.8	7	0.91	25.2
8	0.96	16.3	9	0.09	84.7	10	0.91	23.9	11	0.64	50.3
12	-0.47	118.3	13	0.83	33.7	14	-0.94	159.7			

CONSTRUCT 4

5	-0.22	102.4	6	0.06	86.3	7	-0.46	117.5	8	-0.58	125.3
9	-0.60	127.0	10	-0.78	141.3	11	-0.31	108.1	12	0.12	83.2
13	-0.82	145.5	14	0.57	55.5						

CONSTRUCT 5

6	0.84	33.2	7	0.78	38.4	8	0.74	42.3
9	-0.42	114.7	10	0.59	53.8	11	0.74	42.5
12	-0.87	150.4	13	0.50	60.1	14	-0.80	142.7

CONSTRUCT 6

7	0.48	61.7	8	0.57	55.1	9	-0.48	118.9
10	0.39	66.8	11	0.66	48.6	12	-0.78	141.6
13	0.17	80.0	14	-0.54	122.9			

CONSTRUCT 7

8	-0.86	30.4	9	0.10	84.2	10	0.77	40.0
11	0.72	44.2	12	-0.43	115.7	13	0.83	34.0
14	-0.92	157.0						

CONSTRUCT 8

9	0.15	81.4	10	0.94	20.6	11	0.69	46.1
12	-0.44	116.2	13	0.79	37.6	14	-0.88	152.1

CONSTRUCT 9

10	0.36	68.7	11	0.07	86.2	12	0.59	54.2
13	0.54	57.3	14	-0.16	99.1			

CONSTRUCT 10

11	0.66	48.6	12	-0.34	109.7	13	0.88	27.9
14	-0.84	147.6						

CONSTRUCT 11

12	-0.61	127.8	13	0.64	50.6	14	-0.75	138.5

CONSTRUCT 12

13	-0.22	102.6	14	0.52	58.9

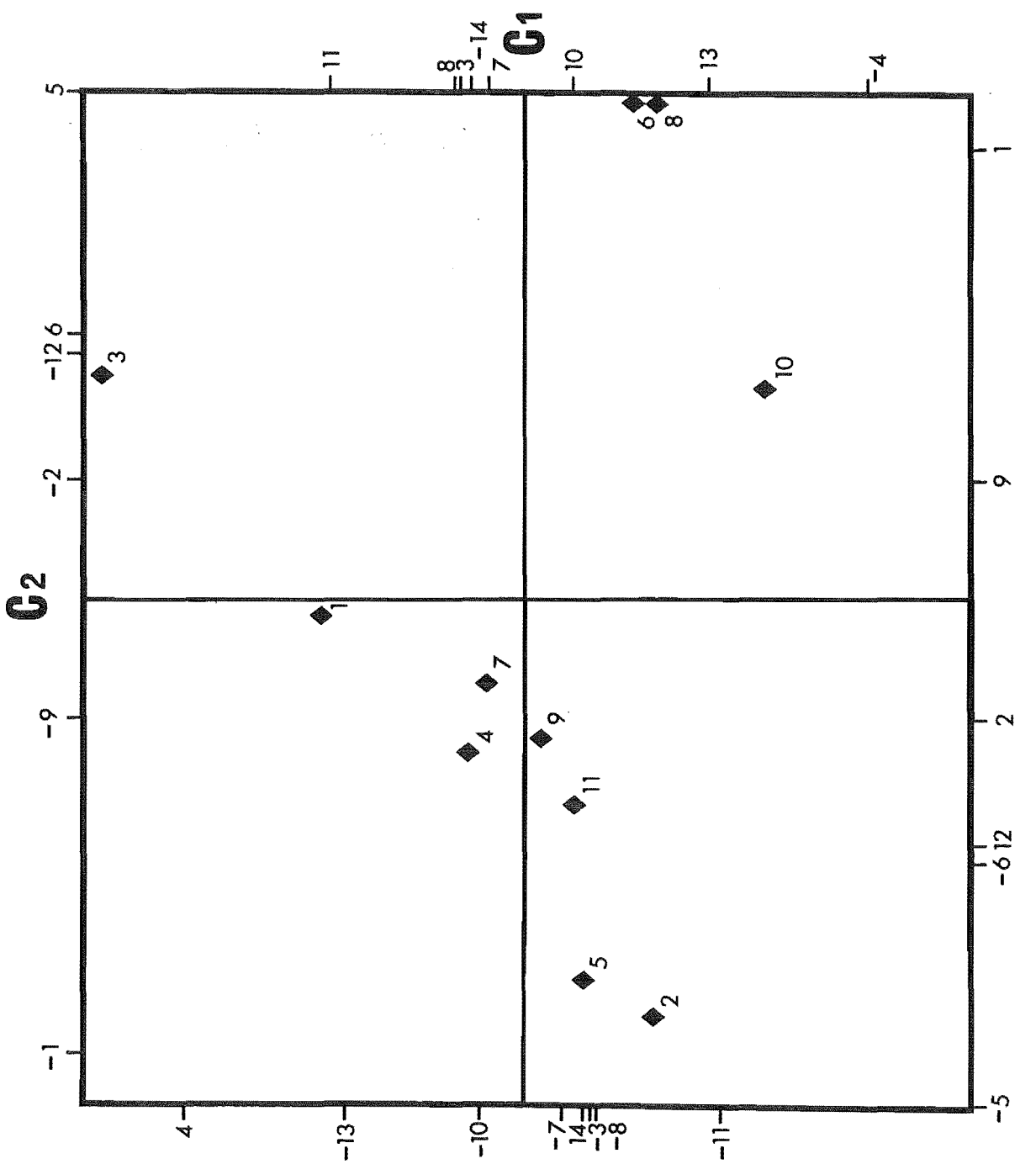
CONSTRUCT 13

14	-0.88	151.4			

The first two components of the non-gambler grid account for 90.3 % of the variance thus a two-component composite diagram (Figure 23) is considered adequate in demonstrating the relationships between the constructs and elements. The component loadings for all the elements and constructs indicate their contribution to the total variance and provide the coordinates for plotting the respective points and axes (Appendix 49).

Fig. 23.

Two component graph of the non-gamblers' STIMULUS GRID



The first component explains 67.6 % of the variance contributed mainly from these constructs and elements along with their contrasts.

positive pole	negative pole
elements	
6 the person I dislike most	2 the person I would like to be
8 the person who usually upsets me	5 the person I admire most
	11 the person whose company I enjoy
constructs	
3 is usually calm/ tends to worry	14 is pessimistic/ is optimistic
8 is not easily/ easily aroused	4 does not like/ likes excitement
13 is not/ is superstitious	
7 does not need/ needs achievement	
1 does not like/ likes to gamble	
10 has a liberal/ conservative outlook	
5 is not concerned about/ fears failure	

The second component accounted for 22.7% of the variance derived mainly from the following elements and constructs.

positive pole	negative pole
elements	
3 the person I was 5 years ago	10 the person whom I find threatening
1 the person I am	
constructs	
6 has high/ low self-esteem	1 does not like/ likes to gamble
	9 does things better alone/ better in a group
	2 does not take/ takes risks

Significance of the results of the STIMULUS GRID

It would appear that for gamblers taking risks is associated with positive, socially admired characteristics such as having high self-esteem, not being concerned about failure, doing things better in a group and preferring uncertain outcomes. This tends to create a picture of risk-taking as an activity engaged in to improve ones interpersonal status, similar to an adolescent's desire for recognition or to appear `cool'. In other words, it may be alleged that gamblers present themselves as rather immature individuals, inferred from the constructs associations. Support for this allegation comes from Livingston's (1974) observation that a glaring characteristic of compulsive gamblers is "a craving for unsolicited attention or

admiration, a desire to attract and enchant all eyes". In the same study Livingston also noted that members of Gamblers Anonymous frequently refer to their past `immaturity' as an explanation for their gambling.

A completely different set of constructs is associated with risk-taking for non-gamblers. This includes excitement, optimism, calmness, liberal outlook and not superstitious giving the impression of a more mature, rational relationship between risk-taking and these constructs. This is a very interesting difference between the two criterion groups and its significance will be further discussed along with the results of the AROUSAL GRID.

Gambling, not surprisingly, is associated only with luck for gamblers which is in turn positively correlated with excitement whereas for non-gamblers luck is unrelated to gambling or gambling related activities. Instead, luck is more associated with more social and personal constructions such as concerns about failure, levels of self-esteem, achievement needs, outlook in life and a pessimistic/ optimistic attitude. Thus, it seems that the seriousness and concerned nature of non-gamblers is also evident in their perceptions of luck compared to the rather frivolous attitude of gamblers. This assertion is further confirmed by the correlation of not liking excitement, having a conservative outlook and being superstitious, with the gambling construct. One could almost feel a sense of aloofness among the non-gamblers possibly approaching contempt towards gamblers for their `weakness'.

In the analyses of the interrelationships between constructs and elements the first components for the gambler and non-gambler grid both contributed about 68 % towards the

variance. Furthermore, the constructs which are prominent in this component are relatively similar and in the case of the elements nearly identical. This means that most of constructions of the person elements are consistent for both the typical gambler and non-gambler. The association of different poles of the same constructs with the same elements provides additional evidence that similar persons were construed in the same manner but differentiated by contrasting poles. This also increases the validity of the grid technique in the comparison between the two groups.

The first component seems to involve positive versus negative features of interpersonal relationships. In both groups THE IDEAL SELF is clustered with THE PERSON I ADMIRED MOST and THE PERSON WHOSE COMPANY I ENJOY which were contrasted with THE PERSON I DISLIKE MOST and THE PERSON WHO USUALLY UPSETS ME. These are associated with their respectively related constructs, the significance of which has already been discussed earlier.

The second component which accounted for 23 % and 11 % of the variance of the non-gambler and gambler grid respectively, appears to contain a strong bias of the self element and gambling construct. One element pole is the same consisting of THE PERSON I AM but with a different contrast for each group- the SELF element is contrasted with THE PERSON I FIND COMFORTING for gamblers and a relatively opposite construct, THE PERSON I FIND THREATENING, for non-gamblers. Self-esteem is associated with the self in the case of non-gamblers and gambling, taking risks and style of doing things associated with the threatening person. Gamblers, on the other hand, simply relate the gambling construct to the self element. This points to an additional

implication of apprehension to the already unfavourable impression of gamblers and gambling activities by the non-gambler.

The third component is only important for gamblers, accounting for 8 % of the variance. The most salient elements are THE PERSON WHOM I FIND THREATENING and THE PERSON WHOSE COMPANY I ENJOY. From an inspection of the 3-component composite diagram the positive element, the person providing enjoyable company is associated with the certainty of outcome preference whereas the threatening individual is associated with the efficiency of being a loner/ gregarious construct.

A comparison of the self versus ideal self.

To further elaborate on the differences between the two criterion groups, the first two columns comprising of the elements THE PERSON I AM and THE PERSON I WOULD LIKE TO BE, were analysed using a series of t-tests. The two columns were treated as 7-point ratings of the self and ideal self in terms of the 14 constructs provided using the raw data from each individual member of both the gambler and non-gambler group as if they were administered rating questionnaires. A summary of the t-test analyses of the self data is given in Table 18.

Gamblers, as expected, like gambling significantly more than non-gamblers and also, predictably, took more risks as well. Although both gamblers and non-gamblers like excitement gamblers again prefer significantly more excitement. Gamblers showed a need for achievement which was significantly greater than the relatively high rating of the same construct by the non-gamblers. Although the high

Table 18. A summary of the t-tests for the self data (1 = gambler, 2 = non-gambler)

CONSTRUCTS		MEAN	S.D.	T-VAL.	2-TAIL PROB.
1 does not/ likes to gamble	1	5.54	1.45	6.66	0.000 **
	2	2.44	1.34		
2 does not/ takes risks	1	4.92	1.19	2.84	0.007 **
	2	3.60	1.47		
3 calm/ tends to worry	1	4.00	1.68	0.66	0.512
	2	3.63	1.64		
4 does not/ likes excitement	1	6.23	0.60	2.62	0.013 *
	2	5.11	1.48		
5 unconcerned/ fears failure	1	4.77	2.05	-0.01	0.989
	2	4.78	1.70		
6 has high/ low self-esteem	1	2.23	1.01	-3.57	0.001 **
	2	3.74	1.35		
7 does not/ needs achievement	1	6.00	1.41	2.15	0.038 *
	2	4.89	1.58		
8 not easily/ easily aroused	1	5.23	1.48	1.97	0.057
	2	4.19	1.62		
9 does better alone/ in group	1	4.08	2.10	2.94	0.006 **
	2	2.56	1.19		
10 liberal/ conservative outlook	1	3.08	1.80	-0.32	0.751
	2	3.26	1.84		
11 does not/ believes in luck	1	5.62	0.96	3.64	0.001 **
	2	3.63	1.84		
12 known/ uncertain outcomes	1	4.38	2.22	2.21	0.033 *
	2	3.07	1.49		
13 is not/ is superstitious	1	4.00	1.63	2.51	0.016 *
	2	2.59	1.67		
14 is pessimistic/ optimistic	1	5.23	1.69	1.66	0.106
	2	4.30	1.66		

(no. of gamblers = 13, no. of non-gamblers = 27, df = 38)
* denotes $p < 0.05$, ** denotes $p < 0.01$

achievement need could possibly be attributed to the student subject sample it is commonly observed that a trade mark of a compulsive gambler is his `big ego' (Livingston, 1974). Other significant differences between the two groups show that gamblers, compared to non-gamblers, do things better in a group, believe in luck more, prefer uncertain outcomes and are more superstitious, all confirming characteristics which have been previously attributed to gamblers.

One rather unexpected result was that gamblers perceived themselves to have higher self-esteem than non-gamblers. Although there has been no research which showed that gamblers have either higher or lower self-esteem compulsive gamblers have been described as being egotistical, striving for power and constantly competing in an attempt to beat someone else, but more often the `system' (Zola, 1963).

This would give the impression of the gambler as an individual of low rather than high self-esteem. However, it is quite possible that high self-esteem is a characteristic of social gamblers and low self-esteem one of compulsive gamblers. Assuming that compulsive gamblers were once social gamblers the high self-esteem that they previously had could have been eroded and replaced by a poorer perception of themselves due to the difficulties encountered and deteriorating circumstances which are part and parcel of compulsive gambling.

The two groups gave similar ratings to the following constructs; calmness/ worry, not concerned about/ fears failure, is not easily/ is easily aroused, has a liberal/ conservative outlook and being pessimistic/ optimistic. It would appear that these characteristics are not as important as the others in discriminating between the two groups. It is surprising that gamblers were not significantly more optimistic than non-gamblers since this trend has been quite consistent in the gambling literature and, especially, throughout this thesis. Since actual gambling was involved when ratings were taken in this study it may be that the optimism of gamblers apply to gambling activities but not in other areas of life.

Similar analyses were performed on the ideal self data which consisted of the ratings on the element the person I would like to be. A summary of the t-test results of the ideal self data is given in Table 19.

Table 19. A summary of the t-tests for the ideal-self data (1=gambler, 2=non-gambler).

CONSTRUCTS		MEAN	S.D.	T-VAL.	2-TAIL PROB.
1 does not/ likes to gamble	1	5.23	1.64	5.66	0.000 **
	2	2.40	1.39		
2 does not/ takes risks	1	5.23	1.42	2.31	0.026 *
	2	3.93	1.77		
3 calm/ tends to worry	1	2.00	1.08	-0.68	0.504
	2	2.26	1.16		
4 does not/ likes excitement	1	6.23	0.93	2.64	0.012 *
	2	5.07	1.43		
5 unconcerned/ fears failure	1	3.54	2.07	0.38	0.708
	2	3.30	1.82		
6 has high/ low self-esteem	1	1.85	1.21	-1.67	0.104
	2	2.48	1.09		
7 does not/ needs achievement	1	5.23	2.24	2.21	0.033 *
	2	3.89	1.55		
8 not easily/ easily aroused	1	4.38	1.85	1.99	0.054
	2	3.22	1.67		
9 does better alone/ in group	1	3.85	2.23	0.47	0.640
	2	3.56	1.60		
10 liberal/ conservative outlook	1	2.15	1.73	-1.40	0.170
	2	2.85	1.35		
11 does not/ believes in luck	1	4.62	2.14	1.89	0.067
	2	3.37	1.86		
12 known/ uncertain outcomes	1	3.31	2.36	-0.51	0.611
	2	3.62	1.57		
13 is not/ is superstitious	1	3.38	2.18	2.20	0.034 *
	2	2.11	1.45		
14 is pessimistic/ optimistic	1	5.77	1.48	0.79	0.435
	2	5.30	1.90		

(no. of gamblers = 13, no. of non-gamblers = 27, df = 38)
* denotes $p < 0.05$, ** denotes $p < 0.01$.

Half of the significant differences between the two groups disappeared when the subjects rated how they would like to be as compared to what they were. The ideal person for gamblers still likes to gamble, takes risks, needs achievement, likes excitement and is superstitious significantly more than non-gamblers. All the constructs listed appeared to be gambling related except for achievement needs. This observation together with the above discussion on the egotistical nature of gamblers suggests that the need for achievement may represent a genuine characteristic of gamblers. The ratings of excitement and gambling levels on the self and ideal self are similar for both gamblers and non-gamblers suggesting that these aspects of the self are quite acceptable. A certain degree of stability in these constructions is also implicated. It is interesting to note that gamblers, ideally, do not wish to have such a high belief in luck and preference for uncertain outcomes although these constructs, like optimism, may be readily subjected to change under gambling situations.

Overall, it appears that there are several constructions which seem to differentiate gamblers from non-gamblers and these are relatively stable and consistent. With reference to gamblers some constructs, perhaps, only become manifested under gambling conditions but are relatively unapparent on other occasions.

The AROUSAL GRID

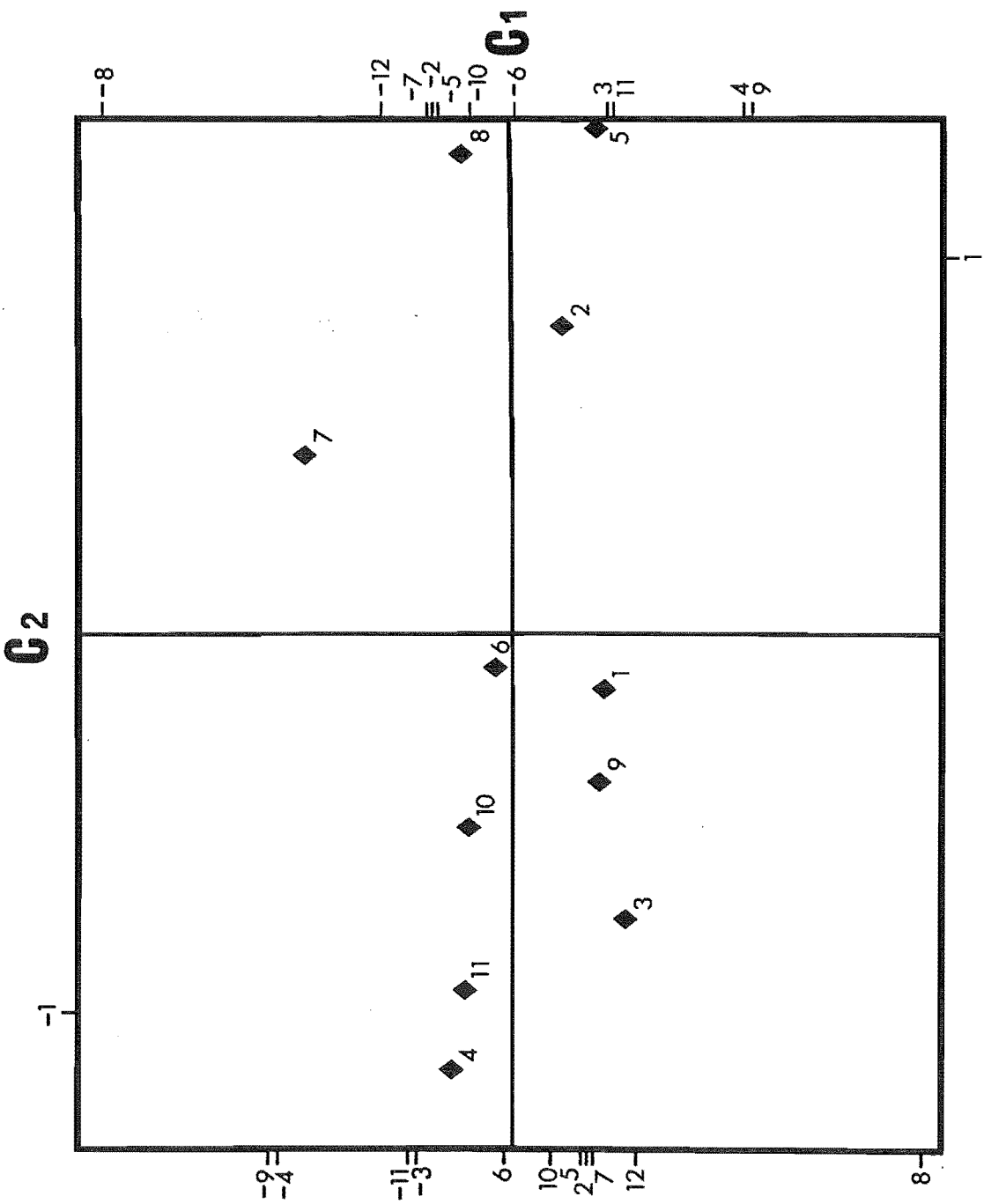
The AROUSAL GRIDs derived from the 48 gamblers and 48 non-gamblers were averaged by using Slater's SERIES program. Unfortunately, there was very little documentation available on SERIES analysis which meant that the analyses were restricted to two `consensus' grids, again representing the typical gambler and non-gambler. The values for each of the construct cells were obtained by summing the general mean to the differences of each of the element mean subtracted by the general mean, obtainable from the output of the SERIES analysis. The two resultant grids were then analysed individually using the INGRID 72 program. The non-normalising option was selected so that the principal component analysis, element-element and element-construct interrelationships were derived from the `raw' entries obtained by the method described above.

The gambler AROUSAL GRID

For this analysis the major points of interest are not so much the interrelations between constructs themselves but the element-element and element-construct relationships. The inter-element relations are available in the output as cosines (which can be treated as similar to correlations) and degrees (Appendix 50). The relationships are represented in a more concise manner on a two-component composite diagram (Figure 24) which are derived from the vector loadings of the principal components analysis (see Appendix 51).

Fig. 24.

Two component graph of the gamblers' AROUSAL GRID



It can be seen that the elements, at first glance, are divided into two major clusters diametrically opposed to each other. The element superstitious behaviour appears isolated from the rest of the elements. However, closer examination of the correlations and vectors expressed in cosines and degrees show that superstitious behaviour is negatively correlated with elements challenge and risk-taking and that the elements decision-making and testing predictions are not related with the other elements. Thus, the two clusters consisted of the elements uncertainty, loss of control and losing money in a bet on one end and, opposing these, the elements; monetary gain, having a bet, beating the system and less inclusively risk-taking.

The relations between constructs and elements (see Appendix 52) are summarised in Table 20 below.

Table 20. The relationships between constructs and elements for gamblers (only correlations of 0.7 and above are included, * and ** indicate correlations of 0.8 and 0.9 or higher respectively).

element	constructs	
	positive corr.	negative corr.
	anger **	thrill **
uncertainty	frustration **	interest **
	depression **	joy **
	remorse **	excitement **
		elation **
		optimism *

	anger **	anxiety
loss of control	frustration **	thrill *
	depression **	interest **
	remorse **	joy **
		excitement *
		elation **
		optimism *
	anger **	thrill **
losing money	frustration *	interest **
in a bet	depression *	joy **
	remorse **	excitement **
		determination *
		elation **
		optimism
decision-making	determination	
		thrill
superstitious		excitement
behaviour		determination **
		optimism
		elation
	thrill **	anxiety
	interest **	anger **
monetary gain	joy **	frustration **
	excitement **	depression **
	elation **	remorse **
	optimism*	

	thrill *	anger **
	interest *	frustration **
having a bet	joy *	depression **
	excitement *	remorse *
	elation *	
	optimism*	
	thrill **	anger **
	interest *	frustration **
beating the	joy **	depression *
system	excitement **	remorse *
	elation **	
	optimism *	
	thrill **	anger
challenge	interest **	remorse *
	joy **	
	excitement **	
	determination **	
	elation **	
	optimism **	
	thrill *	
	interest	
	joy	
risk-taking	excitement *	
	determination *	
	elation	
	optimism *	

It is clear from Table 19 that the three elements MONETARY GAIN, HAVING A BET and BEATING THE SYSTEM are construed as direct opposites to LOSS OF CONTROL, UNCERTAINTY and LOSING MONEY IN A BET with almost identical constructs correlated. The only two differences are the extra negative correlation of anxiety with LOSS OF CONTROL and determination with LOSING MONEY IN A BET. CHALLENGE and RISK-TAKING are both associated similarly with the positive emotions by gamblers and a negative correlation between CHALLENGE and constructs anger and remorse which is interestingly absent in risk-taking. DECISION-MAKING is construed in terms of determination while SUPERSTITIOUS BEHAVIOUR is negatively correlated with the positive emotions.

The first component, contributing 88 % of the variance, could really be regarded as a gambling component since the elements and constructs are biased towards gambling. This, more or less, summarises the relationships between the elements and constructs as follows:

First component

elements

positive pole	negative pole
2 uncertainty	3 challenge
5 loss of control	4 monetary gain
8 losing money in a bet	9 risk-taking
	10 having a bet
	11 beating the system

constructs

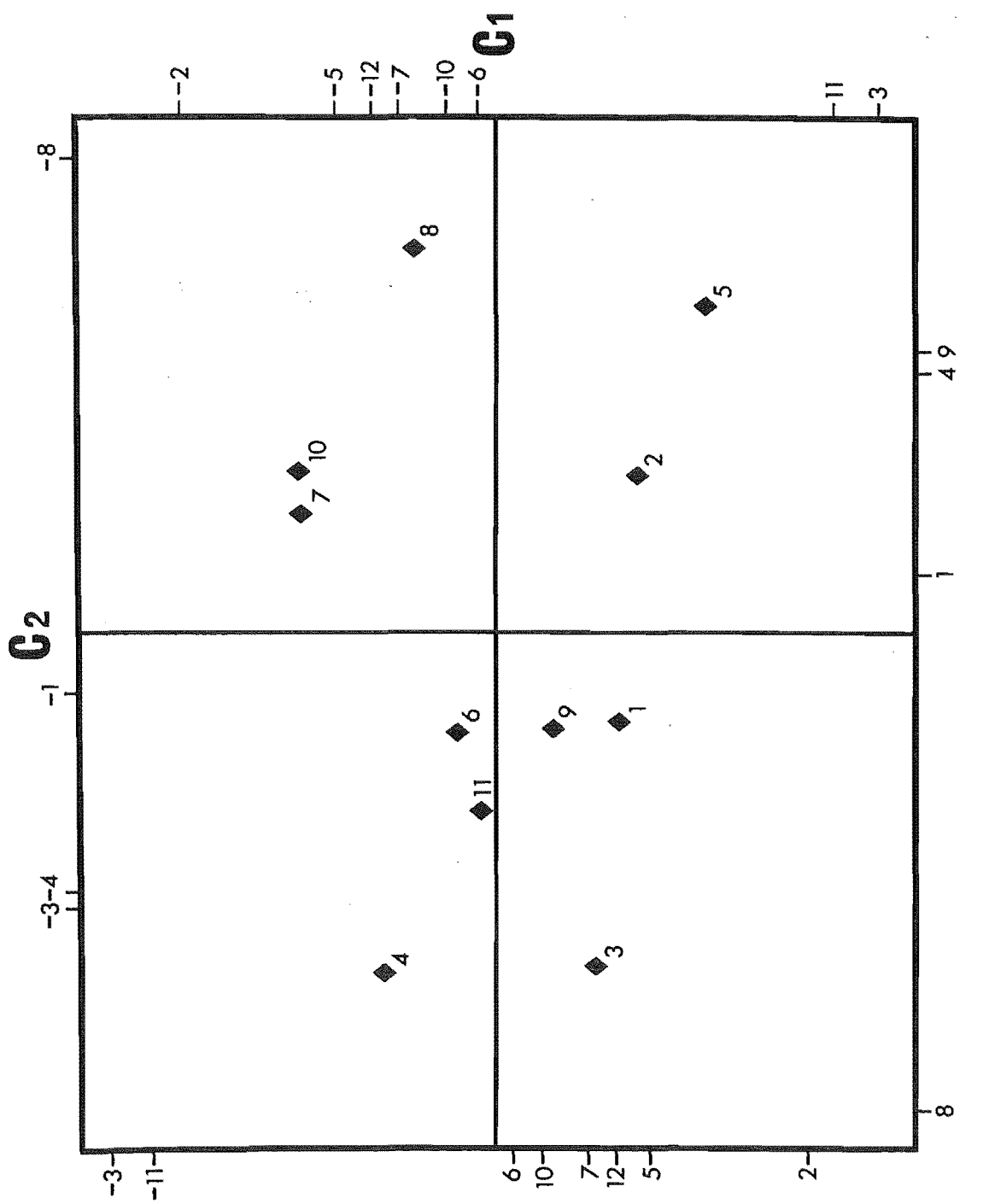
3 anger	2 thrill
4 frustration	5 interest
9 depression	6 joy
11 remorse	7 excitement
1 anxiety	8 determination
	10 elation
	12 optimism

For gamblers the positive emotions are associated with gambling and its related situations and negative emotions related to unpleasant consequences of gambling.

The second component contributes 7 % of the remaining variance and the most salient element is superstitious behaviour which is contrasted with decision-making. If a line passing through the origin, joining the two emergent opposing poles of the second component, were to be drawn it would most closely correspond to the axis of the construct determination. Decision-making is thus associated with determination and, implicitly, superstitious behaviour is associated with with no determination.

Fig. 25.

Two component graph of the non-gamblers' AROUSAL GRID.



The non-gambler AROUSAL GRID

The grid for the typical non-gambler was derived and analysed using exactly the same procedures as for the gambler grid. The inter-element relations are obtained (Appendix 53), and discussed in association with the two-component composite diagram (Figure 25) derived from the vector loadings of the principal component analysis (Appendix 54).

From the composite diagram the distribution of elements in the construct space is not immediately apparent. There is, however, an obvious cluster of 5 constructs the axes of which appear to pass through a significant number of element points. The inter-relations between the constructs and elements are further elaborated by an output (Appendix 55) which is summarised in Table 21 below.

Table 21. The relationships between constructs and elements for non-gamblers (again only correlations of 0.7 and above are presented and correlations of equal to or greater than 0.8 and 0.9 are indicated respectively by * and **.

element	positive corr.	negative corr.
	interest	
decision-making	determination *	
	optimism	
	anger *	
uncertainty	frustration **	
	depression *	
	remorse *	
	thrill **	

	interest **	
	joy **	
challenge	excitement **	
	determination **	
	elation **	
	optimism **	
	thrill *	anger
	interest	frustration
monetary gain	joy **	remorse
	excitement *	
	elation **	
	optimism	
	anger **	thrill
loss of control	frustration *	joy
	depression *	excitement
	remorse **	elation
	interest	anger *
testing	joy	depression
predictions	optimism	remorse *
superstitious		determination *
behaviour		
		interest *
having a bet		excitement
		determination **
		optimism

		thrill **
		interest **
losing money in		joy **
a bet		excitement **
		determination **
		elation **
		optimism **
risk-taking	thrill	
	excitement	
	thrill **	remorse
beating the	joy **	
system	excitement *	
	elation **	
	optimism	

From Table 21 there are two obvious contrasting pairs of elements; the element CHALLENGE is perfectly contrasted with LOSING MONEY IN A BET, and it is also worth noting that the correlation between the elements and the constructs are all 0.9 and over, and the second close contrast is between the elements DECISION-MAKING and HAVING A BET. The remaining elements do not show clear relationships in terms of the provided constructs. The final analysis which should further clarify the inter-relations involves looking at the nature of the components derived from the principal components analysis.

The first component contributed 70 % of the total variance and the associated elements and constructs are summarised below.

First component

elements

positive pole	negative pole
2 uncertainty	3 challenge
5 loss of control	4 monetary gain
8 losing money in a bet	6 testing predictions
	9 risk-taking
	11 beating the system

constructs

3 anger	2 thrill
4 frustration	5 interest
9 depression	6 joy
11 remorse	7 excitement
	8 determination
	10 elation
	12 optimism

The first component appears to describe an adventurous, competitive, sensation-seekinging set of situations for non-gamblers. The ambiguity of situations is seen as a challenge to be tested and risked for a chance of monetary gain or beating the system. These successful situations are understandably construed positively. In contrast, the close association of LOSS OF CONTROL and LOSING MONEY IN A BET with UNCERTAINTY creates the impression that uncertainty in this context is probably better interpreted as being unable to control the situation or a state of helplessness. Appropriately, these situations are construed in terms of

severe negative emotional feelings.

The second component explains 22 % of the remaining variation with the following elements and constructs associated.

Second component

elements

positive pole	negative pole
4 monetary gain	1 decision-making
7 superstitious behaviour	2 uncertainty
10 having a bet	5 loss of control

constructs

1 anxiety
3 anger
4 frustration
5 depression
11 remorse

It is interesting to note that there are no constructs closely associated with the three gambling elements perceived by non-gamblers. The most important observation here is that HAVING A BET, SUPERSTITIOUS BEHAVIOUR and MONETARY GAIN are construed similarly, the implication being that for non-gamblers betting is a superstitious behaviour indulged mainly for monetary gain. Contrasted with these the elements decision-making, uncertainty, and loss of control clustered around the opposing end of this seemingly gambling component, and these are construed negatively.

Significance of the results of the AROUSAL GRIDS

The major difference between the first component of the gamblers' and non-gamblers' grids is that for gamblers HAVING

A BET is included amongst the elements MONETARY GAIN, BEATING THE SYSTEM, CHALLENGE and RISK-TAKING whereas, TESTING PREDICTIONS is substituted in place of HAVING A BET for non-gamblers. The rest of the correlations, of contrasting elements and associated constructs are virtually identical. This suggests that, on the one hand, the first component (88 % of the variance) reflects a strong betting or gambling content for gamblers while on the other hand, the first component (70 % of the variance) of non-gamblers is more of an inquisitive, competitive and venturesome nature. It also appears that both gamblers and non-gamblers construed negative situations such as uncertainty, loss of control and losing money in a bet in similar negative terms. For gamblers losing money in a bet is perceived to be an unpleasant situation in the same mould as uncertainty and losing control. This is contrary to the popular view that gamblers do not mind losing money. The two positions can be incorporated by the proposition that it is not so much the money that worries the gamblers but the fact that the money was lost which signifies to the gamblers a feeling of being beaten. It has been mentioned earlier that for compulsive gamblers money is a tool for gambling and its loss is of no great consequence. However, the situation may be different for social gamblers in that money is of greater value since it provides a medium for gambling but, more importantly, winning it is a sign of success. This is especially obvious when monetary gain is associated with having a bet construed in terms of joy, elation, thrill, excitement, and other positive emotions.

The important elements associated with the second component (7 % variance) for gamblers is superstitious

behaviour contrasted with decision-making construed in terms of determination. Non-gamblers appear to construe the second component (22 % variance) as one of gambling. The point to note is that although gamblers are seen as superstitious by other people, especially non-gamblers, they themselves are not prone to associate gambling with superstition. Instead, for gamblers superstition is more related to behavioural events such as making decisions as opposed to the non-gamblers perception of gambling as a superstitious behaviour indulged in for monetary gain. Again one gets the impression that gambling behaviour is really belittled by non-gamblers. For them, gambling and associated situations are not at all construed positively unlike gamblers, and the contrasting situations uncertainty, losing control and decision-making are in turn construed in negative terms.

Discussion

A number of interesting observations emerged from the analyses of both the gamblers' and non-gamblers' STIMULUS and AROUSAL grids. The t-tests of the self and ideal self data also revealed useful information.

In the gamblers' construction gambling is closely associated with a belief in luck but gambling is construed by non-gamblers to be related to superstition, conservatism and excitement. The construct takes risks is related to excitement, optimism, calmness/worry, outlook in life and superstition for gamblers while non-gamblers tend to associate risk-taking with doing things better alone or in a group, outcome preference, failure and self-esteem. The final major difference between the two groups is the construction of the belief in luck. Gamblers associate it with excitement as well as gambling whereas non-gamblers associate belief in luck in terms of failure, self-esteem, needs achievement, outlook in life and pessimism. There is a similar cluster of the constructs calmness/worry, failure, self-esteem, outlook in life, superstition and optimism/pessimism for both gamblers and non-gamblers. The construct arousal is not associated with any other construct in the non-gambler group while for gamblers, in addition to arousal, doing things better alone or in a group and outcome preferences are not related to other constructs.

It has been mentioned that the relationships between the constructs for gamblers implied a desire for recognition and immaturity but a more rational and disdainful picture is presented by non-gamblers, all this mainly in relation to gambling. It is also clear that gamblers tend to construe

gambling and risk-taking along with other constructs that have been previously shown to be associated with gambling such as luck, excitement, superstition and optimism. Non-gamblers, in addition to some gambling constructs, tend to relate gambling and risk-taking also to personality type constructs including self-esteem, outlook in life, and failure. In other words, gamblers seem to be more gambling orientated in their construing as opposed to a social and personal approach of non-gamblers especially where gambling and risk-taking are concerned.

A comparison of the self perception of the gambler and non-gambler groups confirms that gamblers are aware of their gambling and risk-taking tendencies. Furthermore, the ideal self differences show that gamblers are not worried about their gambling interests and imply a willingness to retain the status quo. It is quite interesting that the ideal self for gamblers include significantly higher needs for achievement than non-gamblers suggesting an important perceived characteristic of gamblers.

It appears that the situations uncertainty, loss of control and losing money in a bet are construed by gamblers as opposites of monetary gain, having a bet and beating the system. For non-gamblers a challenging situation is perfectly contrasted with losing money in a bet and a less precise contrast between decision making and having a bet. The first major component of the principal component analysis is derived from a similar set of elements and constructs and their contrasts for both gamblers and non-gamblers but the first component of the gambler grid contributes about 88 % of the variance compared to 70 % from the non-gamblers grid. The other difference is that the first component for gamblers

has a heavy emphasis on gambling whereas for non-gamblers it seem to embody a more competitive and adventurous nature.

There is an unexpected similarity in the constructions of uncertainty, losing money in a bet and loss of control by both the gamblers and non-gamblers. It was suggested that the close associations of the three constructs implied a sense of helplessness rather than merely not knowing what to expect and/or how to proceed. These situations are construed in intense negative terms. Since gamblers so frequently take risks in their gambling pursuits it has been suggested that losing money is nothing new to them and they might even seek uncertainty to increase their arousal level. However, as mentioned before, uncertainty may have been interpreted in a different manner in this context. It is asserted that gamblers dislike uncertainty just like everbody else because they do not feel in control of the situation. The effect that is desired is more like a delayed unknown result, one which is usually revealed in the immediate future. This could explain the inconsistencies in the locus of control studies. Furthermore, the control experienced may simply be a perceived entity.

The second component deals with superstitious behaviour for both gamblers and non-gamblers but has more importance for the latter since it absorbs three times the remaining variance. It appears to contain a gambling bias for non-gamblers. It is curious to note that there are not many reports from gamblers suggesting their obsession in a superstitious habit. Most of the claim regarding the synonymy of superstition and gambling usually come from researchers and non-gamblers. It may be a consistent denial on the part of gamblers or an unconscious belief in fate and

the supernatural. In any case, the concept of superstition and luck in the gambling context is particularly interesting and will be discussed in greater detail in a later chapter.

Throughout the analyses of both the STIMULUS and AROUSAL grids one gets the impression that gambling behaviour is condoned, wanted and enjoyed by gamblers. A different attitude seems to emerge from the non-gamblers' constructions. Gambling is seen, more or less, as a detrimental behaviour, indulged for avaricious intent using illogical, superstitious methods. It is difficult to determine how these cognitive differences arise but it would not seem too far fetched to suggest that they are a result of the circumstance. In other words, in the case of gamblers, gambling becomes a pleasurable activity through a social learning process with the help of a variety of reinforcers including increased self-esteem, satisfaction in winning, fulfilling achievement needs and thrill besides the more obvious monetary gain. The attitude of the non-gamblers is probably derived from a necessity to explain their non-participation and for some a disdain for gambling. The easiest way to achieve this is to degrade gambling as evidenced in the constructions of persons and situations from the grid analyses.

From the above analysis it would appear that the superordinate construct which differentiates gamblers and non-gamblers is the attitude towards gambling. Gamblers tend to construe gambling in positive terms. Non-gamblers are less appreciative of the pleasure that can be derived from gambling and are normally uncomplimentary towards the activity and its participants. This unfavourable disposition on the part of non-gamblers may have arisen from the

observation of compulsive gamblers who do not generally create a good impression by their behaviour. The main point here is that besides having a different attitude towards gambling and its related activities gamblers also share quite a few things in common with non-gamblers. Whether this cognitive dissimilarity pervades the personality structure of these two groups is still uncertain. From the current state of research it appears that there are a number of personality characteristics which tended to be associated with both social and compulsive gamblers although there is a paucity of data on the former group. Considering the prevalence of the disease conception of compulsive gambling it will be enlightening to study the intermediate stage in the progression of the disease since a number of implications follow from the model.

It can be seen that the repertory grid is a useful tool in the study of gambling behaviour. Although the data in the present experiment were grouped and the operators and operands in the grid not totally `personal' the technique still provides a quick and efficient method of obtaining a lot of information from an individual in a relatively short period of time. The resulting constructs are a sample of an individual's semantic space and, in Kelly's definition, part of his personality. The fact that the range is restricted and incomplete need not make the repertory grid any worse or less satisfactory than other personality test. Indeed, the looser structuring of the repertory grid has the advantage of allowing the individual to tell us in his own way how he views some of his circumstances (Duck, 1973). Inferences are made on the assumption that statistical relationships within the grid reflect psychological relationships within the

person's construing system. These psychological relationships represent something relatively stable and permanent in a person's construct system provided that the rules of statistics are observed when interpreting the grid results even though the level of statistical significance required for accurate prediction is still unresolved (Fransella and Bannister, 1977).

In conclusion, the grid technique can be gainfully employed in gambling research especially in the early stages of an investigation. A number of interesting results were obtained from the two repertory grids that were presented to the gamblers and non-gamblers. These results provided implications that might have been less obvious with other measurement techniques.

CHAPTER SEVEN

THE ASSOCIATION OF LUCK AND SUPERSTITION WITH GAMBLING.

In this chapter an attempt is made to find the link between the notions of luck and superstition and gambling behaviour. It is very common for people to associate the concepts of luck and superstition with gamblers and gambling activity. Many authors have mentioned this relationship but few have considered how these concepts relate to gambling and why there should be any relationship at all. A brief review of the notions of luck and superstition will be necessary before they can be discussed in the gambling context.

Luck

A number of references to luck have already been made in the previous chapters and the influences and belief in luck are investigated in the present studies. It must be remembered that the present discussion of luck is limited to its effects under situations of uncertainty and gambling.

Along with methodical studies on gambling in the mid-fifties to the late-sixties, Cohen and his associates included a fair amount of empirical work into luck research. Cohen (1960) reviewed many interesting instances of the importance of luck in ancient societies. In an early study, Cohen found that when asked the meaning of luck students gave two typical responses: one, that it means an unearned advantage or something fortunate happening to a person without any effort on his/her part; and the other is that what happens is unexpected or `against the odds' or `a fortuitous outside influence'. Cohen and Hansel (1956) found

that juveniles and adolescents tend to believe they have stores of luck that can be depleted and replenished, in the sense that if one of two players has been winning for some time, he/she has used up his luck, while his/her opponent's store has remained intact and is therefore more likely to win in the future.

In the same study, other features of luck were obtained from three groups of subjects; 8-year-olds, 14-year-olds and 19-year-old students. Eight-year-old children have on the average one lucky number, day, and colour, and sometimes more than one. Among 19-year-old (students), about one in two has a lucky number and one in three has a lucky day or colour. Numbers are thought to be lucky by 8-year-olds (children) because they are associated with colours; because they have gained prizes at fairs or raffles; because they are linked with gifts; because they relate to birthdays or ages of the family or the size of the family; because they refer to house-doors or registers at school; or because they are linked with lucky stones or charms. The most common reason for describing certain days as lucky by children is that they are the occasion for pleasant events, such as receiving gifts. Children feel that colours are lucky if they are fond of them or think they are nice, or because they make a good effect in drawing or they may be the colour of lucky teams or badges. Older subjects mostly say they enjoy wearing a particular colour and therefore feel well or confident in it.

Several other questions regarding certain situations were also presented to these subjects to assess the extent to which luck was believed to be attached to a person and how this belief changed with increasing age. The situation involved a raffle with a hundred tickets of which one was the

winning ticket. One hundred persons drew a ticket from a box and put it back. The subjects were told that they have a chance to draw a ticket and win a prize and then asked the number of people they thought would be lucky enough to draw the winning ticket. Children thought that about 50 would be lucky, the corresponding figure for the 14-year-olds (adolescents) and students being 5 and 2 respectively. Increase in age and intelligence make the guess resemble more what would actually happen.

A related question asked was that if they (the subjects) had more than one attempt, how many would they need to be lucky. There was great variability in the responses: among children, from 2 to 99 (median = 4); among adolescents, from 8 to 100 (median = 23); and among students from 5 to 100 or more (median = 30). Again, increasing age brought about increasing realism although there was a clear tendency for even the older students to overrate the chances of drawing the winning ticket. This could be a result of a poor understanding of probabilities and randomness (Teigen, 1983a, b, c, d; Tversky & Kahneman, 1974), or a belief in some supernatural force which influences events. Before actually drawing their tickets subjects were asked whether they themselves would be lucky. About 25 percent of the children expected to be lucky and draw the winning ticket but only 12 percent of the older subjects thought they would be lucky. Another study using Training College students and Grammar School boys aged about 15 when asked the same question yielded a figure of 10 percent. There was also a sex difference, 12 percent of females felt lucky compared to 7 percent of the males in drawing the winning ticket.

About 20 percent of the subjects in all the age groups

felt that they were generally lucky. For the younger subjects it was because they had won games or raffles, got sums right, had a lucky stone or coin or lots of nice things, or because their wishes were often unexpectedly gratified. Some thought they were lucky (or unlucky) before they played a certain game and therefore won (or lost) it; others thought they were lucky (or unlucky) because they had won (or lost) the game. The reasons given by 19-year-olds were different. Some said they were lucky because they had been successful without effort, in other words, an unearned advantage. A larger proportion identified luck with fortuitous events.

The next series of experiments in Cohen (1959) looked at the concept of luck in terms of performance. Two types of tasks were used, one where the outcome could not be estimated on an a priori basis, but only in the light of previous experience of similar tasks, in this case, to estimate how many times they would succeed if they were to throw a ball into a basket at distances of 2, 4, or 12 feet. In the other task, the outcome of which could be predicted on a priori basis, the subjects had to estimate how many blue beads would appear if 10 beads were drawn at random, with replacement, from an urn containing blue and yellow beads well mixed. Similarly, there were 3 levels of difficulty: (1) 90 blue and 10 yellow beads in the urn; (2) 50 blue and 50 yellow; and (3) 10 blue and 90 yellow. Subjects were asked to estimate their success under five conditions: (1) if they were lucky; (2) if they were unlucky; (3) if they were as lucky as they could possibly be; (4) if they were as unlucky as they could possibly be; and (5) if they were as realistic as possible in making their judgements. The results showed that expectations of success

depend on how difficult the task appears to the individual. When the task seems very easy it is believed that one will be successful however unlucky one feels, on the other hand, when the task appears very difficult one thinks that one will always fail however lucky one feels. At the point of maximum uncertainty of either success or failure one is least accurate in estimating the amount of luck as compared to the realistic values.

Another question concerned the effect on actual performance if the subjects were lucky, unlucky, very lucky and very unlucky. The results indicated that when subjects felt lucky they hoped for an improvement of 6 to 12 percent. An expectation of very lucky implies a hoped-for improvement of 12 to 26 percent. An expectation of unlucky carries the belief that performance will deteriorate by 15 to 40 percent, whilst an expectation of a very unlucky performance implies a deterioration of about 17 to 80 percent. In other words, lucky and unlucky are not thought of as affecting performance symmetrically about a realistic average. The decrement expected to occur as a result of unlucky is about three times as great as the increment which luck is expected to bring; the discrepancy is nearly as great between the increment due to `very lucky' and the decrement due to `very unlucky'. Cohen suggested that it was a reasonable observation because in practice there are more factors which impair performance than improve it.

The final question was addressed to finding out how often one thinks one is lucky or unlucky, since the frequency with which good or ill fortune befalls oneself may be an important aspect of the idea of luck. Subjects first stated the various performances they believe they could achieve with

different degrees of luck and unluck respectively. Then they were required to say how often in 100 trials they thought each of these performances would occur. The results showed that realistic situations will occur on about 52 percent of the occasions, lucky or unlucky outcomes on about 17 percent, and very lucky or very unlucky outcomes on about 7 percent of the occasions.

All three aspects of luck involve a relationship between a person and a task. In the more primitive or childlike notions, luck is supposed to inhere in a person or thing or a period of time, like some indwelling spirit. The present observation reveals a more sophisticated concept which provides a way of stating that ones performances and achievements are not uniformly good or bad but are unequally, though systematically, distributed over a range that extends from the extreme of bad to the extreme of good. People seem to be aware of the fluctuation that characterises any series of attempts at a task and that these changes are not random but are influenced by a multitude of factors, including `unearned advantage' and `fortuitous intervention', which they ascribe to the operations of luck.

Cohen (1960) suggested that the vigorous belief in luck, accompanied by a host of luck-bearing devices to trap good fortune and circumvent evil, is an antidote invented by man to help him in coping with the inescapable uncertainties of daily existence. Furthermore, in a competitive culture, the idea of luck may serve as a stabiliser, conveniently, that is, to the lucky ones, and at the same time stultifying initiative and independent thinking. If someone makes a fortune merely because the person is believed by others to be lucky, and not through having the right connections or

special merit the individual will be safe from envy. Similarly, the unsuccessful need not lose face, they are merely unlucky (Merton 1949).

The experiments of Cohen (1959) showed the various influences of luck on the behaviour of the individual. Another aspect of the potency of luck was demonstrated by Taylor (1967). In an experiment presented as one on extra-sensory perception, subjects were asked to guess the sequence of colours in a shuffled pack of playing cards. After a preliminary run, those scoring high (lucky) were separated from those scoring low (unlucky). The subjects were then required to engage in another round of guessing the colours. On a chance basis, one would expect both groups to perform equally well in the second guessing task but the results showed that the `lucky' group continued to do significantly better than the `unlucky' group. The author cautiously pointed out that his data provided some empirical support for the popular notion of luck. The procedure followed for the experiment was quite reasonable with an appropriate statistical test used. For this kind of study a large sample should be used to prevent any chance effects. There were only 12 subjects each in the lucky and unlucky groups thus it is possible that the result may have been a coincidental grouping of those who performed better and those who did not perform as well. Taylor also mentioned that assumptions in statistical procedures may be violated when response criteria are derived from measures involving responses to chance-determined events. On the other hand, one may be unjustifiably sceptical about the influences of luck.

The above discussion showed that there are a number of

features that characterise notions of luck and its potency under various situations. The use of some aspect of luck in everyday life is a common occurrence in most individuals. Such frequent usage of luck implies its importance in human dealings. Merton (1949) stated that both the eminently `successful' and the eminently `unsuccessful' in our society quite frequently attribute the outcome to `luck'. For the successful, it is in psychological terms, a disarming expression of modesty. In sociological terms, the doctrine of luck as expounded by the successful serves the dual function of explaining the frequent discrepancy between merit and reward while keeping immune from criticism a social structure which allows this discrepancy to become frequent. On a micro level, for the unsuccessful, particularly for those among the unsuccessful who find little reward for their merit and their effort, the doctrine of luck serves the psychological function of enabling them to preserve their self-esteem in the face of failure. This orientation toward chance and risk-taking accentuated by the strains of frustrated aspirations may help explain the marked interest in gambling (Merton, 1949).

It also appears that the more chancy an operation, the more necessary it is to the peace of mind of the individual to summon the assistance of supernatural forces (Maple, 1971). Thus, it is perhaps not very surprising to find such a close relationship between gambling and the belief in luck since, by definition, an element of chance exists in any real gambling activity.

Superstition

Superstition is a term which has always been closely

associated with discussions on luck. In one of the first major studies on superstitions, Maller and Lundeen (1933) described a superstitious belief as one that ascribes causal relationship to phenomena and objects which bear no such relationship to one another. Maple (1971), in a similar vein, commented that superstition has been well described as a belief or system of beliefs, based on imaginary connections between events and incapable of being justified on rational grounds. Although this definition seems quite reasonable Jahoda (1970) maintained that there is no objective means of distinguishing superstition from other types of belief and action and that the term is relative to time and place.

The results of Maller and Lundeen (1933) indicated that the effectiveness of each of the sources including friends, home, observation, and education, whether it is in the direction of fostering superstition or correcting superstitions, depends on the total background of the individual. The same source may be fostering superstition in one individual and correcting superstitions in another. This observation subtly hinted that personality factors may be involved in the acquisition of superstitions. Indeed, more recent research provides some support for this assertion. Boshier's (1973) study partly supported the propositions of Adorno, Frenkel-Brunswik, Levinson and Sanford (1950) that, "superstition is a central component of the highly conservative fascistic type person and indicates a tendency to shift responsibility from the individual on to outside forces beyond his control; it indicates that the ego might already have `given up', that is to say, renounced the idea that it might determine the individual's fate by overcoming external forces." Another study, (Liddell and Morgan, 1978),

provided some evidence that ritualistic compulsions in early teens could predict later levels of neuroticism and that there may also be an association between obsessionality and phobic superstitions in young adults. Windholz and Diamant (1974) were able to show that the superstitious individual is characterised as impulsive rather than controlled, reflective rather than practical, neurotic rather than well adjusted, and showing characteristics of a schizoid group.

These psychological correlates of superstitions should not totally overshadow the importance of environmental influences for it is obviously the interaction between the person and the surroundings which gives rise to the superstitious beliefs and behaviour. This assertion is well demonstrated by Skinner (1948; also, Morse & Skinner, 1957) in which a type of superstition is developed in pigeons. Using operant conditioning, he was able to establish firmly the behaviour patterns that happen to precede the presentation of the reinforcement. The bird made swiping motions with its head behaving as if there were a causal relation between its behaviour and the presentation of food, although such a relation was lacking. The superstitious rituals are not due only to the fact that a reinforcing stimulus strengthens any behaviour that may happen to follow, even though a contingency has not been explicitly arranged, but also to the fact that the change in behaviour resulting from one accidental contingency makes similar accidents more probable.

It appears that human beings are no more rational than pigeons when it comes to superstitions. Merton (1949) stated that the best seed-ground for superstition is a society in which the fortunes of men seem to bear practically no

relation to their merits and efforts. In a society suffering from anomie, the ordinary virtues of diligence, honesty, and kindliness seem to be of little avail. As a result, people tend to put stress on mysticism: the workings of fortune, chance and luck. Jahoda (1969) suggested that where people are deficient in the rational understanding of an uncertain environment they have a greater tendency to resort to superstitious ideas. Superstition creates a false sense of security in a situation which demands serious thought and positive action (Maple, 1971) and may thus serve the function of reducing anxiety, since it provides at least the subjective feeling of predictability and control.

To summarise, the relevance of luck and superstition to gambling behaviour appears to stem from the nature of uncertainty in gambling. In Halliday & Fuller's (1974) definition one of the fundamental ingredients of gambling behaviour is that the determining process always involves an element of chance, and may be only chance. Work done to assess the effects of these influences on gamblers in their gambling decisions is virtually non-existent except for Cohen's studies. Given the prevalence of gambling activity in so many aspects of living it seems strange that so little attention has been devoted to the effects of a belief in these two constructs. From the results of the present studies it appears that there are differences between the associations of gambling, and luck and superstitions. It may be possible that some of the inclination to gamble may have arisen from a distorted belief in luck and that superstitious practices follow the participation in gambling. Besides serving social functions such as allaying envy and providing justification for failure in the unsuccessful a belief in

luck and superstition may also provide confidence in ones decisions thus reducing anxiety and stress. No doubt more research in this field will reveal interesting information.

CHAPTER EIGHT

OVERALL DISCUSSION

Personality characteristics of gamblers.

In the initial study an attempt was made to identify some personality characteristics of pathological gamblers (GA members) and social gamblers with a non-gambler control group. One of the aims was to assesss the applicability of non-clinical tests in mapping personality characteristics of a clinical population. Carey (1968) reported that the 16 PF could differentiate pathological gamblers from non-gamblers. Unfortunately, the actual differences are unknown since the original Carey study is unobtainable.

The results of the present study showed that none of the 16 factors significantly differentiated between the three groups. However, in a comparison of high risk-takers and low risk-takers, Zaleski (1980) found that both males and females can be differentiated on the 16 PF. High risk-takers score significantly higher on the E (Humble/Assertive), H (Shy/Venturesome), I (Tough-minded/Tender-minded) and M (Practical/Imaginative) than low risk-takers. To generalise, risk-takers compared to low risk-takers are more impulsive, assertive, impatient and excitable. They are more self-confident, less conventional and have a stronger need for power and status. They want to be noticed and appreciated by others but in situations of conflict they seem to have a higher level of tolerance. However, Zaleski's high risk-taking subjects were not economic gamblers *per se* but individuals who chose the more risky alternative on the Choice Dilemmas Questionnaire (Kogan & Wallach, 1964).

Although the traits appear to describe the gambler reasonably well it is still too early to suggest that monetary risk-takers (gamblers) also take greater risks in other areas of their lives. There is some evidence that risk-taking in various activities is related (Williams, 1965) and a suggestion of risk-taking as a personality trait (Knowles et al., 1973) but other studies tended to point out the considerable lack of agreement among what are supposed to be measures of the same general characteristic (Slovic, 1962; 1964). It is probably more realistic to accept that there is more than one facet of risk-taking as demonstrated by Jackson et al., (1972). The author would like to reiterate that the only individuals studied in this research are those involved in economic risk-taking.

At this stage, there are only two consistent personality characteristics which have been shown to be associated with compulsive or pathological gamblers, that is, they have a higher locus of control and higher neuroticism score than non-gamblers. One reason for the small number of characteristics identified may be the limited range of personality questionnaires that have been presented to such gamblers. But we may learn from the experience in personality research in alcoholism where numerous studies are required to clearly pin-point the real nature of alcoholics (Cox, 1979) to enable a refinement of classification and screening procedures for optimal treatment modalities. Cox also pointed out that alcoholics represent a wide diversity of personality subtypes. A lot of resources can be saved and channelled towards more fruitful projects if the multi-dimensionality of risks and the existence of personality subgroups among gamblers is acknowledged (Moran,

1970b; Kusyszyn, 1972).

The study of the personality characteristics of social, non-problematic gamblers is important because it may provide some indication as to the causes or consequences of some characteristics. For example, if a particular characteristic is present in both social gamblers and pathological gamblers then it will be safer to conclude that that trait predisposes the behaviour rather than resulting from it. In the other case where the characteristic is only present in pathological gamblers and not in social gamblers then ascribing predisposing qualities to the trait would be rash. However, it has been fairly well established that traits and the situations interact to form the measured personality at that moment (Magnusson, 1976; Endler, 1976; Endler & Magnusson, 1976; Mischel, 1977). More empirical research with gamblers under gambling and non-gambling situations will be required to clarify the issue of relative importance of individual and situational factors.

It is common knowledge that there are many social gamblers who never progress to the pathological stage. Proponents of the disease conception of pathological gambling (such as GA members) assert that it is only a matter of time before a social gambler turn into a pathological one and under certain conditions (for example, an adversity in life or a windfall) the transition is accelerated. The social gambling stage is a required link. If such is the case, studies concentrating on social gamblers are not only important but also practical since early detection and intervention in diseases produce better prognosis. Yet studies on social gamblers and gambling are not common, that is, excluding those using student populations. In most

societies, the research priorities of dealing with the sick and abnormal may reflect a preoccupation with healing and treating symptoms rather than preventive measures. The level of funding for research to ease the suffering of those already afflicted undoubtedly plays a large part in the state of affairs but in the long run preventive medicine yields better results.

The relationship between gambling with the locus of control, recall, luck and reinforcement.

After the initial inquiry into the personality differences of pathological gamblers, social gamblers and non-gamblers, it became increasingly apparent that social gamblers and especially pathological gamblers would be difficult subject populations to obtain for research. To overcome the diminishing pool of gambler-subjects student subjects were used. The majority of studies on risk-taking or gambling in the laboratory typically involved paid student volunteers or those participating for course credits and allowing them to keep a portion of their winnings to maintain their interest. Although not entirely novel, it was ensured that the students used for the following studies have characteristics other than being merely students, such as having a higher/ lower locus of control, or being social gamblers/ or non-gamblers so that more information may be gathered by separating them in terms of the attribute studied. Besides, the readily accessible student population can provide good heuristic data.

In the next experiment, one of the major questions asked was whether internals or externals take more monetary risks in the laboratory situation. Another question was the recall

performance of the two groups in terms of the gambling events. It seems reasonable to assume that gamblers, who enjoy taking chances and taking risks in chance determined activities, are naturally individuals with an external control orientation. In the few studies of internal-external orientation of gamblers the traditional method is to present an I-E scale to a group of gamblers and, if the investigation is more thorough, to a control group of non-gamblers at the same time.

The generalisation of the attribute of an external control orientation from the observation of a frequent risking of money in mainly chance-determined activities is questioned. The results from the study of risk-taking by high and low locus of control subjects showed that this relationship is not always true. The weakness of the assumption may lie in the implied transitivity of the relationship between external control and higher risk-taking. Risk-taking propensity in individuals is not consistently correlated with an external locus of control and neither is an external locus of control consistently correlated with risk-taking including gambling. Indeed it would be surprising and would be extremely unlikely if such a simple relationship exists given the varied procedures for the selection of risk-takers and gamblers and locus of control measurements.

The results of control orientation and risk-taking have been conflicting to date. It has been shown that externals take more risks (Liverant & Scodel, 1960; Moran, 1970a; Conrad, 1978; Wong, 1980, cited in Dickerson, 1984) and also that internals take more risks as well (Strickland et al., 1966; Baron, 1968). It may not be a coincidence that the

Moran, Wong and Conrad studies using pathological, GA members and race-track gamblers showed an external orientation while the remaining three studies showing no external relationship with gambling were laboratory studies.

Perhaps, only individuals habitually or seriously involved with gambling have an external control orientation or it could be that there may exist two kinds of externals in the Western society (Rotter, 1975). These are the defensive externals who rationalise or project the control of powerful others in their lives and the passive externals who logically accept the learned external attitudes. Rotter commented that Levenson's (1973) distinction of belief in powerful others versus a belief in chance overlaps that of defensive and passive externals. Some of the contradictions in the reported results may be resolved by regrouping the pathological gamblers as passive externals and occasional or social gamblers as defensive externals. The rationale for the assignment of these descriptors to these groups stems from personality research which suggests that although pathological gamblers exhibit more pathological or socially less desirable characteristics than social gamblers, defensiveness is evident in social gamblers (Conrad, 1978) but has never been reported to characterise pathological gamblers. Social gamblers may be more disposed to rationalise their participation in chance activities whereas pathological gamblers do not have the same inclination since, for them, gambling is a serious activity not really engaged in for recreational purposes. It is a need, compulsion or addiction to internal urges which are often brought upon by external stimuli.

The following classification of the various types of gamblers and their locus of control propensity is suggested.

Internals	Externals		
	Belief in chance and luck	Defensive	Passive
Non-gamblers	Occasional gamblers	Social gamblers	Pathological gamblers

The only difference between non-gamblers and occasional gamblers in terms of the internal-external distinction is a greater belief in luck and a stronger influence of chance factors in their lives for occasional gamblers. In other areas such as the influence of powerful others and the perception of their own ability for achievement they are quite internal in nature which makes them appear rather similar to non-gamblers. As mentioned previously, the studies comparing risk-taking in internals and externals have generally used college or school samples without reference to their subjects' gambling participation. This, together with the proposition that there are likely differences in internality-externality among the various categories of gamblers, may have lead to the inconsistencies among past research.

Future research into gamblers and their locus of control should investigate the relationship between passive and defensive externality or a belief in chance or powerful others among different types of gamblers. This may provide some implications for the scales now in use for the measurement of locus of control orientation. Items which

contain some elements of risk-taking may have to be included considering that risk-taking is so common in ordinary life and that risk-taking and locus of control have been shown to be related.

Subjects provided with information on luck were less accurate in the recall and estimation tasks than when they were not informed. In a game which was primarily determined by chance females were also shown to rate themselves more unlucky than males in the same situation.

Another variable which is considered to be important in gambling activities is the retention in memory of the events occurring during gambling by the participants. Some of the retention may be assessed by recall and post-estimation tasks. Two of the more salient features of the gambling process were investigated, namely, the numbers of the dice that were rolled and the amount of money that was involved during the gambling session. Recall of stimuli (the numbers chosen by subjects to put their bets on) was better when the situation was negative, such as the experience of more losses than wins. Gilovich (1983) also found that losses in gambling are better remembered after a longer period (two weeks). Most people who make wagers would have more episodes of losing encoded in memory but these do not seem to deter them from further participation in betting. This suggests that individuals who occasionally or more frequently gamble may have an encoding of winning and losing events which is biased towards winning or that they are super optimistic in nature. It may also be possible that the outcome of gambling is unimportant, that is, these people gamble because they enjoy gambling and are willing to pay for it, which results in them accepting gambles with the knowledge that the odds

are against them or bets with a negative expected value. This may provide a valid explanation for the failure of the original maximisation of expected value model.

The recall of numbers that least and most frequently occurred in the rolls of the dice mainly differentiated internals from externals. The results strongly support the finding that the frequency of occurrence of infrequent events tends to be over-estimated while the occurrence of comparatively frequent events is under-estimated. An interaction showed that internals are no more accurate than externals. Under chance conditions, externals tend to over-estimate the occurrences of infrequent events more than internals while both internals and externals tend to under-estimate the occurrences of frequent events. Since the over- and under-estimation is such an established phenomenon in human judgement (Kahneman et al., 1982) the finding of differential recall performance of internals and externals along these lines an addition of an over- and under-estimation item in the locus of control scales may further improve the distinction between the two groups. However, more research will be required and perhaps a re-analysis of some of the previous data.

In terms of the estimation of the amount of money staked internals were more accurate than externals. This was attributed to the internals' characteristic of better attention to, and utilisation of, information. The estimation of the amount of money won or lost during the gambling session did not show a simple superior internal-inferior external performance division. An interaction showed that external males were most accurate in their estimation and external females least accurate with the

internal males and females in between. This was explained in terms of the greater exposure of gambling experiences in the males and the lower personal control of females of college age in addition to the traditional internal-external differences.

The consideration of gambling as stimulus-bound behaviour.

The discussion of gamblers as being influenced by external factors and observations of responsiveness to stimuli, especially those related to gambling activity, led to the idea that gamblers may be stimulus-bound in a manner similar to that suggested to account for the eating behaviour of over-weight individuals in the late sixties. Theoretically it is probably more appropriate to ascribe stimulus-binding to gambling behaviour since there is less necessity to account for an internal sensitivity which remained an obstacle in the explanation of stimulus-binding in over-weight individuals. There are no internal conditions in a gambler which are equivalent to `stomach rumblings' to characterise a state of hunger or a release of insulin in response to visual, auditory and olfactory food cues in the externally responsive over-weight individual, at least, with the knowledge of the internal functioning of gamblers that is presently available. Externality, in obesity research, was later acknowledged to be more a characteristic of the general population rather than just that of the over-weight. The shift in emphasis has only minor impact on the proposed stimulus-bound characteristics of gamblers. Gamblers could still be shown to be externals.

However, the results obtained did not support the

contention that social gamblers are more external than a control group of non-gamblers. It was suggested that perhaps the external sensitivity was only applicable to gambling stimuli. When considered in this vein, the expression `external sensitivity' could be substituted by the basic operant concept of `discriminative stimulus'. At first glance it may seem to be a strange substitution but when the behaviours elicited by these two concepts are compared they appear to be quite similar and the major difference lies in the terminology within the particular theoretical framework. It is felt that the operant framework offers a more concrete and precise set of definitions which are supported and have been refined by a large amount of research. Furthermore, discriminative stimuli also provide a plausible explanation of the chain of events which follows the initial positive response to the stimulus concerned, by supplying reinforcers for each behavioural response in the chain.

Thus, starting from an observation of the similarity of gamblers and over-weight individuals in their reaction to certain stimuli it was then hypothesised that gamblers might also perform equally well in tasks that have been shown to reflect external responsiveness. Social gamblers were not found to be responsive in these tasks. It was suggested that the responsiveness may only be to gambling related stimuli and that the terminology could be changed to an operant one with greater clarity and explanatory power.

<u>The effects of reinforcement history, gambling cues and arousal on the gambling behaviour of social gamblers and non-gamblers.</u>

A number of indices have been employed in gambling

research to assess the risk-taking of subjects under certain conditions of uncertainty, probability of payoff and the amount to be won or lost. One of the major and easily identified index of risk-taking used in this experiment and also throughout this thesis is the amount of money subjects are willing to risk in a particular gamble. The choice of probabilities of the outcomes and the associated payoffs for the respective outcome are the other common measurements of risk. It has already been shown in previous research that other factors are also important in explaining risky decisions. These included; expected value and utility, the beliefs in the importance of probabilities and payoff, and risk-seeking interest of the person. Other less commonly or rarely discussed factors which may be influential in risky decisions are:

1. the belief in luck and the importance of luck in gambling decisions;
2. the differences between one-off gambles or sequential gambling and related to that, the effects of the outcomes of the previous trial, or series of similar outcomes, and the ratio of the history of wins and losses encountered;
3. the effects of environmental cues surrounding the gambling situation;
4. other psychological factors such as the interest in and pleasure of gambling; related to that are the confidence, skill and experience in gambling activities;
5. personality factors including, locus of control, need for achievement, impulsivity, extraversion and neuroticism;
6. the sensation-seeking motive and the arousal level of the person concerned.

This research has been an attempted to qualify some of

these factors. Most serious researchers in gambling behaviour would agree that it cannot be explained by one or two general concepts such as greed for money or being under the control of intermittent schedules of reinforcement. Other factors including those listed above are likely to play a part in the initial decision to participate in gambling or in the maintenance of the gambling activity. Although there was no direct intention to show that the above factors are instrumental in initiating or maintaining gambling behaviour demonstrating the differences between social gamblers and non-gamblers on these variables may give an indication of their possible contribution to the participation in gambling.

Bearing in mind that a secondary objective of this thesis is a comparison between social gamblers and non-gamblers some of the results obtained would be more appropriate for listing the similarities and differences in these two groups rather than testing general theories of gambling behaviour though some inferences may be made from observed characteristics of the two groups. The major index used for the comparison between social gamblers and non-gamblers is their betting behaviour under the influences of the various manipulated stimulus conditions. An individual's confidence in winning the next bet or making the correct choice offers an alternative to the size of stakes in determining the potency of the variables.

A. Probability, skill and chance perception and preferences, and recall.

The first task is to look at the findings from the rating data collectively and suggest some plausible explanations. When presented with a choice of payment, one

which consists of a fixed sum and the other uncertain amount of money but with a possibility of receiving more than the former, social gamblers prefer the uncertain alternative. Social gamblers perceived that more skill was involved in the chance game than non-gamblers although Anderson & Brown (1984) did not find any difference in the perception of skill or chance involvement in blackjack in his gambler/ non-gambler samples. They concluded that the higher stakes placed by gamblers cannot be attributed by the perception of a greater skill component in the game (blackjack).

The results of the present study showed that, in terms of the probability preference, social gamblers chose the lower while non-gamblers chose the higher probability of winning a higher and lower amount of money respectively. Social gamblers were also more optimistic about winning in the gambling session before they start than non-gamblers. These observations could be explained in learning terms. With greater participation in gambling, gamblers would have encountered more successes and losses than non-gamblers. At the same time if gamblers have a biased encoding system whereby more success than failure events are stored in memory, this process may create a false sense of control over the outcome of events over a period of time. The above observations then seem to be more coherent. The preference of more uncertain alternatives, lower probability of occurrence of an event and greater optimism expressed may be a result of this encoding bias of positive events over negative ones into memory. Some support for this line of reasoning comes from the results which showed that even though social gamblers perceived that there is a higher skill involvement in a chance game than non-gamblers, the amount of

chance and skill present in a chance game preferred by social gamblers and non-gamblers are about the same. This would indicate that social gamblers really dislike uncontrollable, chance events as much as non-gamblers but because of an illusion of control acquired over a period of time via a faulty encoding system, for gamblers, chance events are perceived to have a skill component and the uncertainty of the outcomes of those events occurring is reduced in comparison to non-gamblers.

The earlier study comparing the gambling behaviour of internals and externals and the influences of luck and the ratio of payoffs showed that recall of losses by subjects was better than recall for wins. Similarly, the recall of the numbers chosen by subjects to put their bets on was best when subjects experienced the least number of payoffs indicating that events were better remembered following negative outcomes. In the present experiment the hypothesis which is generated states that social gamblers selectively encode more success events than failure events compared to non-gamblers. The next step would be to run a similar experiment to the former one and compare the recall performance of gamblers and non-gamblers. If losses or losing-related events are better remembered by non-gamblers and gamblers show better recall for wins and winning-related events then it can be concluded that in gambling, losses are more salient for non-gamblers while for gamblers wins are more important. The generality of such a relationship can easily be tested in a non-gambling situation where the recall of, say, the results of a series of games in a tournament, is compared between gamblers and non-gamblers.

Such a line of investigation may eventually lead to the

question of the `need' of gamblers to be reinforced more often and the possibility that they are more responsive to positive events than non-gamblers. Gamblers may display such behaviour because of a lower self-esteem, lower self-efficacy or even an insecurity about themselves and their abilities. It may be argued that previous personality research (see earlier review and Dickerson, 1984) did not find any such characteristics but it should be pointed out that those studies generally involved pathological gamblers, not social, non-problematic gamblers. Furthermore, investigators typically only look for limited characteristics such as introversion-extraversion, neuroticism and locus of control. A more direct and perhaps less clinically orientated approach may be necessary to ascertain the existence of the proposed attributes in gamblers, both social and pathological. Further research is needed before the influences of these features in gambling activities can be determined.

B. Luck and superstition.

The perceived role of luck by people presents an intriguing area of study. The attributes of luck seem to be amplified under conditions of uncertainty such as gambling. In a previous review of luck and superstition, the adult notion of luck is most frequently described as a fortuitous intervention followed less frequently by the description of an unearned advantage. Furthermore, people seem to have the idea that a person has so much luck in store, so that after a run of bad luck, good luck is to be expected, hence the sayings `every cloud has a silver lining', `there is a calm before the storm' and so on. In a sense the possession of luck functions as a form of natural justice. The other

feature of luck is that good and bad luck do not have the same potency. The increment in performance lucky and very lucky is expected to bring is only one third of the decrement due to unlucky or very unlucky respectively.

Individuals also seem to over-estimate their `luckiness' in terms of their chances of success in a random event such as drawing a winning ticket, compared to the objective probability. Older people were shown to be more realistic, stating that more numbers of draws were required before a person is considered lucky. Another study compared the chance of the number of people (out of 100) who are lucky enough to draw a winner out of 100 tickets. Again older subjects were found to be more realistic and less dependent on luck. Taking these results and that of a higher rating of a belief in luck by social gamblers there may be some justification in the assertion that gamblers lack maturity. But social gamblers are no more likely to keep lucky items among them than non-gamblers. Neither are they any more superstitious. Experimentally, the ratings of luck were shown to be influenced by the reinforcement history. An experience of a favourable ratio of wins over losses immediately prior to the time when the rating was made induced ratings of lucky. This observation indicates that perceptions of luck are also influenced by the situation rather than being wholly determined by the individual's store of luck. It is difficult to make conclusive statements regarding the acquisition of a greater belief in luck since most of the data obtained is of a correlational nature. However, if the selective encoding of positive events by gamblers is accepted then one can argue that the greater belief in and reliance on luck may be a function of

experience, that is, more success events are retained in the memory of a gambler thus creating a `luckier' disposition in the gambler.

Feeling lucky can introduce a feeling of confidence, as if one can `take on the world' because the gods are on ones side. The acceptance of the luck concept also serves a function in society by `allaying discontentment' in people (Cohen, 1960). He explained that;

> If a man makes a fortune merely because he is believed by others to be lucky, not because he has the right connections or any special merit, then he is safe from green-eyed envy. Someone else might have been lucky. Similarly the unsuccessful need not lose face; they are merely unlucky.... The successful ones themselves usually prefer to attribute their good fortune to effort and merit rather than to luck, if only in the interest of their self-esteem, although modesty may require some lip-service to luck.

The above description is fairly typical of gamblers in relating their successes and failures in gambling in that successes are commonly attributed to their personal skill and effort even in a mainly chance-determined activity, and bad luck is often presented as an excuse for misfortunes. In this way losses may be made to become more bearable than when failures are attributed to personal factors, the individual then has to live with both the loss from their failures and a lower appraisal of their abilities at the same time. For people who frequently experience failures or misfortunes, such as gamblers, laying the blame on bad luck constitutes the most palatable justification for themselves and the people for whom an explanation is required.

The association of superstition with gambling is most likely due to the uncertain nature of the outcome of the decisions made in a gambling situation. Ferster, Culbertson & Boren (1975), referring to the fishing practices of the Trobriand Islanders, suggested that superstitious behaviour is only necessary when there is danger and uncertainty involved and where knowledge and skill is reliable superstition does not exist. From the previous review on luck and superstition it seems that a belief in these constructs has the function of reducing cognitive dissonance. Furthermore, decision-making is simplified; for example, certain numbers (or combinations of numbers) are claimed to be luckier than others, thus a selection of these would improve ones chances of success. The decisions are probably arrived at quicker since some of the alternatives are more favourable than others. Other instances of a belief in luck aiding decision-making are a random selection of a number on the roulette table by choosing that number indicated by the accidental dropping of the money which was to be staked (perhaps indicating that the gods have given their divine guidance), or simply varying the size of stakes according to how lucky or unlucky one feels. Similarly, a certain ritual of throwing dice may be followed to ensure the best chances of winning (Henslin, 1967).

In the author's experience, there is a tendency for many individuals in South East Asian Chinese communities to associate a disaster with success in gambling - the license plate number of a car involved in an accident is a favourite for `4-digit', a form of lottery. Dreaming of winning money is not a good omen to go gambling but a dream where there is some element of faeces involved is a sure sign of prosperity.

Likewise, the practice of counting money before the whole gambling session is over and lending money during gambling will lead to great losses whereas generous tipping or a visit to the temple before the gambling session are regarded as luck bringing behaviours. For the more desperate losers a change of clothing or washing of the hands may help change their fortunes at the tables.

From an observer point of view these behaviour may appear laughable but often for the gambler they are performed in earnest although most of them carry out these rituals more as a form of insurance against bad luck than a serious coercion of the gods to turn the outcomes in their favour. One can speculate how these superstitious practices evolved and arrive at very interesting propositions. The many individualistic quirks in the gambling fraternity support the contention that most of these rituals exist mainly because they have been associated with past successes in gambling in much the same way as the pigeons in Skinner's superstition experiment (1948) acquired their superstitious behaviour. However, many superstitions are transmitted from generation to generation through the socialisation process (Maller & Lundeen, 1933) explaining the longevity of some of them.

To sum up, the main factor that associates gambling with luck and superstition is the uncertainty of the gambling situation. The proposed functions of a belief in luck and superstition are an aid in the decision-making process, an injection of confidence, a reduction of cognitive dissonance and quite importantly, a scapegoat for their misfortune.

C. Reinforcement history, gambling cues and arousal.

The gamblers' fallacy is one concept which appears to be

used to mean a choice in variety of situations. In gambling it has been taken to mean:

1. Choosing the alternative which has not appeared for a while as if expecting nature to restore an equilibrium in chance happenings;
2. Choosing the alternative which has appeared a number of times, expecting a run of (lucky) events;
3. Placing a smaller bet following a winning trial or placing a larger bet following a losing trial as if expecting that wins and losses should even out.
4. Placing a smaller bet following a losing trial or placing a larger bet following a winning trial as if expecting a run of bad or good luck.

Cohen (1970) attempted to distinguish between negative recency and the gambler's fallacy. The rationale for his distinction between the two terms is that the choice for a particular alternative may either be further influenced by seeing the gamble as a self-challenge or wanting to impress the spectator or both. This represents a positive recency effect which contributes to the gambler's fallacy.

The results of this study helps to clarify the situation. It appears that gambler's fallacy and recency effects may be differentiatied in terms of the cognitive aspects of the decision, in this case, the conviction in making the right decisions or making correct predictions.

Strictly speaking the original usage of the term gambler's fallacy refers to the first situation (Jarvik, 1946; 1951). In a binary event one either commits fallacies 1 or 2, which is to say whatever decision is made one is committing a fallacy. Thus to follow some form of logic, in the second case it could be called the non-gambler's fallacy.

Under normal circumstances, one might be reluctant to disgrace the non-gambler by naming the second fallacy as such and call it gambler's fallacy II, and the former gambler's fallacy I. There was some evidence to support the proposed classification. In this experiment social gamblers tended to favour the first strategy while non-gamblers appeared consistently to select the second alternative in a chance determined situation. It would seem appropriate then to name the second fallacy the non-gambler's fallacy, to differentiate it from the other three cases.

For fallacies 3 and 4, it may be best to abandon the term gambler's fallacy altogether and refer to positive and negative recency effects. Positive recency effect is thus defined as an increase in confidence or risk-taking resulting from the occurrence of the previously staked number or from experiencing a previous winning outcome. The negative recency effect is the opposite, that is, confidence is decreased by the non-occurrence of the object staked or by the experience of a losing outcome. The outcome of the previous event influences the confidence in terms of the stake placed unlike gambler's or non-gambler's fallacies where it is the choice of horses, dogs or numbers that is influenced. In other words, the major difference between the fallacies and recency effects is in the choice of outcomes and the expression of the confidence in the choices.

All the four decisions listed above can be considered to be `gambling' fallacies since they are all based on fallacious reasoning. Paradoxically, (at least to the gambler, who enjoys the use of `systems') in a mainly chance-determined gambling activity the most successful method or rule to follow while betting is random selection.

These fallacies have been argued to arise from a poor understanding of chance, probability (Tversky & Kahneman, 1974) and randomness (Teigen, 1983a). It can also be argued that even though these decisions are not optimal these rules provide guidelines for decision-making especially in situations where quick responses are required. Although recent studies (Kahneman et al., 1982) have shown that biases in judgements and preferences exist in most people, whether these rules are consciously or unconsciously applied is still uncertain.

It was shown previously that outcomes of preceding gambles do influence the size of the next stake. Another consistent finding was that the ratio of wins and losses plays an important part in determining the betting strategy of subjects. In fact, in the present experiment, the results suggest that the ratio of previous wins and losses and the immediate preceding wins and losses or up to runs of three similar outcomes have a strong influence on the risk-taking behaviour of subjects. The history of payoffs probably indicates the chances of success which differentially changed the confidence after runs of wins or losses with social gamblers more influenced by the negative recency effect while non-gamblers were more susceptible to the positive recency effect. Immediate outcomes especially runs of either wins or losses increased the strength of their influence.

Morgan (1983) showed that the number of initial wins appears to be the more important variable than the actual monetary holdings in determining the risk preference. However, wins and losses are proportional to each other, that is, an increase of one necessarily involves a decrease in the number of the other. Since in most gambling situations the

outcome of bets is either a win or a loss this could be one reason why it is still unclear whether wins or losses are more important in influencing the changes in betting behaviour. Subjects could very well be, and probably are, influenced by both outcomes which makes it difficult to assess the contribution of each type of outcome. The available evidence seems to suggest that previous losses play a more important role than previous wins in gambling decisions (Edwards, 1954; McGlothlin 1956; Myers & Fort, 1963). This is not to be confused with the influence of the probability of losing or perceived risk in making gambling decisions (Slovic, 1967; Nygren, 1977; Coombs et al., 1978). The ratio of the previous number of wins and losses probably alters the subjective probability of winning and losing thus changing the perceived risk of the gambling decisions.

Greenberg & Weiner (1966) found that high risk gambles were preferred by subjects who have received high or low reinforcement ratios rather than those who received an equal number of wins and losses. Positive and negative recency effects respectively, were used to account for the differential effects of the high and low reinforcement ratios. In Leopard's (1978) study, the majority of her subjects took more risks when they had lost than when they had won and subjects were also influenced by run patterns of wins and losses in the amount of risk they took. One explanation given was that the subjective evaluations of the likelihood of winning change with the outcome history as the subject plays. This, in turn, is affected by the individual belief in the gambler's fallacy (negative recency effect in our terminology) or belief in runs of luck (positive recency effect). Both attempts to account for the differences in

betting strategy emphasised the positive and negative recency effects within a group of subjects.

The major weakness in the proposed interpretation is that there is no explanation of why some subjects are influenced by the positive recency effect and others by the negative recency effect. There is some evidence that personality factors may be involved. Hatano & Inagaki (1977) showed that extraverts tended to make `riskier' choices more in and after prolonged favourability of reinforcement but made `less risky' ones significantly more in unfavourable reinforcement sequences than introverts.

In the present experiment, there was an interaction between the reinforcement history experienced and runs of wins or losses. Regardless of wins or losses in the outcome of the previous wager the amount of money bet was lower following an unfavourable reinforcement history while the reverse was true following the experience of a favourable reinforcement history. There were a number of interactions between the reinforcement history and the other manipulated variables on the betting strategy of social gamblers and non-gamblers, providing further evidence that there may be some effect of personality factors. The present results could be summarised in the following manner. In the presence of gambling cues, having runs of 1, 2, or 3 wins encouraged higher risk-taking in social gamblers following a history of a greater number of wins to losses while non-gamblers decreased their stakes under similar conditions. Immediate losses increased the effect of a poor reinforcement history by increasing risking in social gamblers and decreasing risking in non-gamblers compared to the risk that would have been taken when the immediate previous outcomes were wins.

Combining all the available evidence, losses are probably more important than wins, in affecting future gambling decisions. It is suggested that this provides further information to the person in a gambling situation for decision-making in addition to that of the attractiveness of the gamble in terms of payoffs and the probability of winning or losing. As in the case of adopting strategies which are based on objectively fallacious reasoning, in a gambling situation, any extra information which will reduce the uncertainty (even if it only amounts to a subjective reduction) will help in speeding up the decision-making process although not necessarily beneficial for the decision-maker.

When relatively fast decisions are required such as those in roulette (about 2-3 minutes between each spin of the wheel) the staking behaviour may be more influenced by immediate outcomes and in situations where the interval between gambles is longer, for example horse-racing (about 30-40 minutes), the effect of ratios of previous outcomes may be more dominant. This hypothesis may be tested by exposing subjects to both gambling situations with accompanying questionnaires and a recording of their gambling decisions.

The betting strategy was not the only gambling decision that was altered by the reinforcement history. Both social gamblers and non-gamblers were nearly always subjectively more confident of their chances of winning than in making a correct choice after a good reinforcement history. A bad reinforcement history only seems to affect non-gamblers, improving their accuracy, assigning more equivalent values to both these subjective measures since, objectively these values are the same. Interpreting the data another way, one

can say that the biases in gambling responses of social gamblers are more ingrained and are less subjected to environmental influences. Even though there was a constant difference between the two measures for social gamblers the general trend for both social gamblers and non-gamblers was for a lower rating for both measures following a poor reinforcement history.

One relatively unexplored area in gambling research has been the effect of the physical surroundings on the gambling behaviour of those indulging in the activity. The potential influence of these physical cues has not escaped the attention of entrepreneurs in the gambling industry. Dickerson (1977b; 1979) noted that commentaries and the changes marked upon the price board in the betting-shop represented important changes in the environment which may be identified as discriminative stimuli for race-betting behaviour. Other organised gambling establishments have their own style of `persuasion' to indulge in the gambling activity. The flashing lights, loud ringing of bells and other buzzing noises associated with winning money at the fruit-machine and, at times, the announcements over the public address system of machines paying jackpots are examples of the methods to draw attention to the games and especially the payouts (Hess & Diller, 1969). For many patrons these stimuli add to the excitement of the activity.

From the author's observation, in many South-East-Asian countries, wherever a sizeable community of Chinese exists, a number of gambling houses can usually be found. These can roughly be equated to a poor man's casino. These houses usually contain one big barren room, undecorated and unfurnished except for 1-metre square tables accompanied by

four wooden chairs. The arrangement is, of course, perfect for the game of mahjong which is commonly played by a large section of the Chinese population. For every table in the gambling house there are probably one thousand other ones that are being used for the same purpose in the private home. Another common game is `zua pai' which is a card game derived from the pieces in the Chinese chess game. Other card games can be played but the main mode of gambling in these gambling houses is mahjong. Mahjong need not be the noisy game that it is, but many players have commented that half the fun is in banging the tiles heavily against the table when drawing a tile from the wall or when discarding unwanted cards, and in between these proceedings most players usually click the tiles against each other further adding to the din. (Olmsted (1962) in her analysis of a pack of cards would have found mahjong a game rich in connotations. Together with the mannerisms often expressed at a mahjong gambling session there is probably more than enough evidence to enable a Freudian interpretation of masturbatory substitution (Freud, 1953) and beyond). The sounds associated with mahjong-playing and the spartanly furnished surroundings could be identified as the discriminative stimuli in a mahjong gambling setting. Similar analysis of other forms of gambling will probably reveal such stimuli characteristics that are associated with the individual game.

Another related area is the effect of stimuli associated with gambling such as flashy advertisements about a gambling event (for example, annual horse race-meetings such as the New Zealand Cup and the Melbourne Cup) or the recently very popular New Zealand $20 lottery tickets. From the crowds at the race meetings (cleverly promoted by associating it with a

carnival) and the quick sale of the lottery tickets the advertisers have achieved their aim remarkably well. As was suggested earlier, once gamblers have been attracted to the gambling activity it is a relatively easy task to encourage gambling by `setting the occasion' and `putting them in the mood' or using other methods mentioned above. There is no doubt that gambling is an exciting activity but it seems that the perceived excitement can be increased by introducing cues (usually artificially created) which are present during gambling. This testifies to the importance of excitement as reinforcement for gambling both in initiating and maintaining the activity.

The experiment described in chapter five attempted to assess the effect of simple gambling cues on the gambling behaviour of social gamblers and non-gamblers. A number of interesting differences between the two groups were evident even in the introduction of relatively `mild' gambling cues. Only betting behaviour was affected by gambling cues with the other measures of gambling activity such as the expectation of winning and making the right prediction unaffected. Boyd (1976) proposed that excitement can be seen as the gambler's drug. From the results obtained there may be some truth to the statement. Gambling cues were shown to have opposite effects on social gamblers and non-gamblers. Risk-taking was amplified in social gamblers but diminished in non-gamblers in the presence of gambling cues. It was suggested that gambling cues help to create a more realistic gambling atmosphere which is conducive to gambling for social gamblers but inhibits risk-taking in non-gamblers. One of the reasons for this difference may be due to the experience of social gamblers who interpret the situation as arousing and

enjoyable but for non-gamblers who have less or no experience of gambling the increased realism may be aversive. Perhaps non-gamblers do not gamble because they are put off by the excitement of the gambling atmosphere.

Why gambling is more exciting and enjoyable for social gamblers compared to non-gamblers is still unresolved but there is no doubt that differences between these two groups exist. One logical reason for the preference for greater excitement and risk-taking (arousal) is that gamblers are under-aroused individuals with a higher arousal threshold. This hypothesis was indirectly tested although the experiment was designed to assess the effect of different kinds of arousal. The relevance of the U-shaped arousal function in explaining gambling behaviour has been already discussed. Ritchie (1984) asserted that an analysis of gambling behaviour must include emotional components which influence patterns of thinking and attention allocation associated with the gambling situation. That is to say even if the arousal level is not important in determining arousal-seeking by gambling different emotional states (correlated with differing levels of arousal) would still influence the risk-seeking behaviour at the cognitive level. Further mention of arousal in relation to gambling came from Anderson & Brown (1984) who concluded that gambling behaviour may be related to individual differences in sensation-seeking. But they also cautioned that the association between arousal and high sensation-seekers in gambling situations having large bets at stake was only evident in a real gambling situation.

The major weakness of the experiment under discussion is that there was no measurement of the two types of arousal induced. The inclusion of a control group which did not

receive any arousing stimulus offsets the above criticism to a certain extent although the ideal situation would include a control group and continuous measurements of an index of arousal. One of the reasons why heart-rate was not used as an index of arousal was the lack of reliable measuring equipment especially in experiments which involve body movements. In any case, heart-rate is not a satisfactory measure of arousal. Hasset (1978) concluded that tonic measurements of heart-rate and blood pressure give an overall picture of the body's state of mobilisation but heart-rate is a relatively insensitive measure of `psychological discomfort' (Festinger, 1957). Lacey (1967) argued that physiological and behavioural arousal are not necessarily related and that increases in psychological arousal will not necessarily be reflected in physiological change. However, recently Croyle & Cooper (1983) was able to demonstrate that electrodermal activity (skin conductance) provided a robust index of psychological discomfort. Barabasz (1977) argued that in measuring electrodermal activity skin conductance is a better measure than skin resistance. Even when a good measurement of psychological arousal is objectively possible, qualifying the arousal is still difficult especially in a gambling situation where a number of emotions (such as excitement, apprehension, pleasure, depression and joy) have been suggested to operate. From available evidence skin conductance measurements should be encouraged in future studies in gambling research rather than the more popular but dubious heart-rate measure.

Although the manipulations of arousal showed that exercise-arousal and video-arousal have different effects on the gambling behaviour of both social gamblers and

non-gamblers, it cannot be claimed that social gamblers are under-aroused. Video-arousal also appeared to be the more potent of the two arousals introduced in its effects on staking behaviour, ratings of luck and expectations of winning. Both arousals also alter the perception of the skill/ chance nature of the game, rating of chances of winning, making the right prediction and the desire to gamble. The emotional stimulus that was presented was an unpleasant one. It would be interesting to see the effects of positive arousal on the various measures of gambling behaviour used in this study. Ritchie (1984) presented some evidence to show that emotional states affect the early allocation of attention about the visual field. Extrapolating from Ritchie's results it is quite possible that the presentation of a positive arousing stimulus would have different effects on the gambling responses in the present game.

In Rule et al's (1971) study the differential use of betting strategies was taken to reflect the amount of risk taken. This was influenced by the manipulation of arousal; subjects in the high and low arousal conditions exhibited the gambler's fallacy (negative recency effect) by increasing bets after each loss, whereas subjects in the moderate arousal condition did not use this strategy. The results were interpreted in terms of arousal affecting the rationality of the subjects. When subjects are bored or threatened, they play their hunches, not being rationally motivated but when mildly frustrated, not needing more excitement nor being cognitively disrupted by threat, subjects exhibit a more rational strategy. Overall the results of the ratings support a hypothesis in which states

of high arousal are predicted to be associated with low levels of risk-taking.

A significant negative correlation between Sensation-Seeking Scale and anxiety was obtained by Zuckerman et al., (1964) lending support to their hypothesised construct of `optimal stimulation level'. In a study of betting behaviour in response to hypothetical situations, for females, high sensation-seekers took more risks than low sensation-seekers but this relationship was not evident in the male subjects (Zuckerman & Kuhlman, 1978). Further support for the optimal stimulation construct, in terms of gambling decisions, was provided by Kozlowski (1977). His subjects, who were characterised by a strong demand for stimulation, were found to prefer low probabilities (high risk), and subjects with a weak demand for stimulation preferred high probabilities (low risk). In these studies the demand for stimulation or the preference for higher arousal was ascribed to individual differences in arousal or sensation-seeking. Similarly, the present results confirm the viability of such a construct. Furthermore, there is evidence that arousal has different effects on social gamblers and non-gamblers indicating that there are individual differences in the optimal stimulation level or demand in sensation-seeking. Lieblich's (1968) finding that greater monetary risks were taken under higher stress than when under no stress condition and Rule et al's (1971) finding of subjects taking high risks under a high arousal condition could be explained by the existence of a two-arousal regulating mechanisms. Recent theoretical propositions in the field of arousal have favoured a multi-dimensional model (Corcoran, 1981; Eysenck, 1982). The

different arousal mechanisms may also account for the different effects produced by the various types of arousal. Rule et al. (1971) concluded that the effects of different types and level of arousal on decision strategies remain to be explicated. The present study represents an attempt to do so.

A number of years ago Cohen (1972) hinted that a possible cause of gambling in gamblers might be an attempt to obtain arousal although in a more hedonistic sense akin to a rat stimulating the pleasure centres of its hypothalamus. From the research available, it is proposed that the intra-individual differences in arousal level or sensation-seeking may be an important determinant of gambling behaviour in gamblers. Anderson & Brown (1984) concurrently suggested that individual differences in sensation-seeking may be involved in both the repeated seeking of the state and in the capacity to experience it. Although not completely novel, the notion of an arousal-seeking motivation for gambling has been neglected. This is strange since most, if not all, researchers agree on the fact that excitement is one of the main reinforcing qualities in gambling. Boyd (1976) went as far as to say that excitement constitutes the gambler's drug.

There has been no completely satisfactory theory of the motivation to initiate and maintain gambling behaviour. One reason may be that many investigators operate within an overly narrow framework, examples of such are; those advocating economic motives with their mathematical models, proponents of learning models, pathological, personality and last but not least psychoanalytic models. It is hoped that the present research into the differences between social

gamblers and non-gamblers and the proposed model of the sub-aroused, sensation-seeking gambler may have heuristic value and lead to improved explanations of gambling behaviour.

The repertory grid technique - an alternative method in the study of social gamblers and gambling.

On the whole, the repertory grid technique is shown to be a useful tool for research. From the analyses of the repertory grid data, further differences between social gamblers and non-gamblers becomes evident. A number of common claims about the characteristics of gamblers were confirmed but the technique provided extra information which qualified these characteristics. Social gamblers are shown to be interested in gambling and to be aware of their involvement in the activity. Luck is seen as part of gambling and excitement. From other experiments in this study it was possible to infer that social gamblers are willing to take risks. The present grid results give a probable reason for this propensity for risk-taking, one of which is that risk-taking is construed as a positive, socially admired behaviour, being associated with high self-esteem, unconcerned with failure and as a gregarious activity. Losing money is associated with negative emotions for social gamblers showing that the value of money may be more important to them than previously acknowledged by other researchers who have suggested that money is merely a means by which gamblers can indulge in gambling. However, it must be remembered that most of the descriptions of gamblers refer to compulsive or pathological gamblers. With regards to the attitude towards money in the present study social gamblers

appear to view winning money as an accomplishment - having beaten the system. Social gamblers do not appear to describe gambling as superstitious behaviour but seem to appreciate merit in the activity.

It may be appropriate here to mention that not every investigator regards gambling as a deviant behaviour. Livingston (1974, cited by Ashton, 1979) noted that gamblers may be just as healthy as non-gamblers, scoring highly on measures of self-control and keeping control of emotions, especially hostility (which they are more likely to direct toward themselves rather than against others). Dickerson (1984) observed that there are no data to suggest that pathological gamblers are different to other high frequency gamblers who do not seem to experience problems. The less acceptable personality characteristics may just as likely be a result of recent life events as it is a cause of them. External forces may be important determinants of gambling behaviour. The need to see oneself as a winner may encourage the gambler to bet again if he/she loses. Livingston suggested that the gambler has a narrower time and environmental perspective than others, especially where gambling is concerned, which may have presented a deviant picture to the non-gambler. The present study also gives support to McGlothlin's (1954) assertion that gamblers do not gamble for money, but rather to combat boredom.

The major proponent of the positive aspects of gambling is undoubtly Kusyszyn. Kusyszyn & Kallai (1976) found that gamblers were lower on hostility, family discord and anxiety. Other measures of feelings showed that active gamblers are more likely to indicate excitement, power, confidence of winning, feeling like a hero and feeling in control of the

situation, states which are common to Maslow's (1974) descriptions of peak experiences in self-actualised persons. Kusyszyn (1977) further asserted that gambling can be interpreted as self-regulated play within a pleasantly safe fantasy mood. Gambling can be viewed as providing for physical and psychological needs, in that it can lead to an increase in muscle tension and heart-rate, and provide an easy release from reality through activity. Thus, gambling is conceptualised as a behaviour whose goals are increasing arousal and providing self-expression. In other words, gambling allows an easy means of obtaining an optimal level of stimulation and arousal, providing an escape from a humdrum existence, and giving opportunities for gamblers to have an effect on their environment. Kusyszyn (1978, cited in Ashton, 1979) argued that the motive for gambling may have similarities to White's (1959) effectance motivation. In short, when one becomes aroused by effectance, one's existence is confirmed and one also has a sense of worth and an affirmation of ones self. Regardless of the evidence to support the interpretation of gambling as a healthy activity it is, nevertheless, refreshing to view gambling from a perspective different from the prevaling negative, disease model or explanations in terms of indulgence or over-indulgence.

An important exercise in this experiment was a comparison of the self and the ideal self of both the social gamblers and non-gamblers along a range of constructs. Compared to non-gamblers, social gamblers like gambling more, take more risks, do things better in a group, show a greater need for achievement, are more superstitious, have a greater preference for uncertain outcomes, a higher belief in luck

and perceived to have a higher self-esteem. Of the significant differences listed above the only one which appears out of place is a higher perceived self-esteem in social gamblers. This could simply reflect a greater need for self-esteem or a greater preoccupation with the construct in their judgements and decisions. This would certainly explain the association of the self-esteem construct with other gambling studies. Some indirect support comes from a recent study by Wolfgang & Zenker (1982) who showed that subjects who scored high on the Desirability of Control Scale bet significantly more `money' as represented by poker chips than subjects who scored low on the same scale. A similar study produced the same results (Wolfgang, Zenker & Viscusi, 1984) but no evidence of subjects high in control motivation being more susceptible than others to the illusion of control.

A separate comparison of the ideal self of both social gamblers and non-gamblers provided interesting information. Even in the ideal situation, social gamblers still like to gamble more, take more risks, like more excitement and need achievement more than non-gamblers. This may provide indirect support for Atkinson's (1960) hypothesis that need for achievement (nAch) influences gambling behaviour. From the associations of the constructs discussed above, it is tempting to speculate that this need for achievement may be construed as one of `maintaining' ones self-esteem, that is, frequent achievements are required to support the feeling of high self-esteem. Further research will be necessary to clarify the relationship of the need for achievement and self-esteem to gambling behaviour.

However, not all the characteristics that were compared

were rated significantly different by social gamblers and non-gamblers. The ratings on the outlook in life, arousability, feelings about failure, calmness/ worry and pessimism/ optimism attitude were similar in the two criterion groups. A relatively similar rating on these constructs especially arousability and optimism could be due to a difference in the appraisal of the quality of these characteristics. In other words, the apparent similarity in rating could be due to a bias in the perception of these constructs, that is, a gambler may feel optimistic about winning when the probability of the event occurring is .5, but .8 for the non-gambler. When an unqualified rating of optimism is required the rating by the two groups will be similar if such a bias exists. The other explanation which was mentioned earlier was that the difference in arousability and optimism may only become evident in gambling situations.

A number of the socially desirable characteristics that were associated with gambling and risk-taking by social gamblers were only associated with risk-taking by non-gamblers indicating that while risk-taking is construed as a positive behaviour, gambling is not construed as such where non-gamblers are concerned. In fact, gambling was construed by them as a socially undesirable behaviour being associated with not liking excitement, being conservative and superstitious. Other grid results showed that gambling is associated with a threatening person giving the impression that gambling is a negative activity which is disapproved by the non-gambler.

Most of the subjects were young university students so the association of beating the system, monetary gain, challenging and testing predictions with risk-taking was not

surprising for both the social gambler and non-gambler groups. However, it was quite clear that only the social gamblers included having a bet among these positive situations. The other major difference is in the construction of luck. Social gamblers generally associated it with gambling while non-gamblers seemed to associate it with social and personal events. The notions of a close link between luck and superstition often assumed when referring to gamblers and gambling may not be justified from the constructions derived from the grid. Neither social gamblers nor non-gamblers associated luck with superstition in any situation. The only connection between these two constructs was that luck was associated with gambling by social gamblers and superstition associated with gambling by non-gamblers. Briefly summarising the non-gamblers construing of gambling, the grid data showed that it is largely perceived as a superstitious behaviour indulged in for monetary gain.

When alternatives are given as reasons for gambling, all the reasons provided will be used by some people (see Smith & Preston, 1984). Put another way, alternatives may be used for explaining gambling behaviour simply because they are present. In the case of the repertory grid technique how the more unusual elements are construed and what constructs are available will have a great influence on the overall construing of the situation. It is quite a serious drawback of the grid technique if the elements and constructs are indiscriminately included since the responses to these operands and operators are all taken into account in the statistical analysis. Any unreasonable inclusion will undoubtedly result in an erroneous interpretation of the subject. In this instance, when motivational factors are

being investigated it may be more useful to resort to studying individual construing of gambling, eliciting both constructs and elements and interpreting the resultant construct-construct, element-element and construct-element correlations. Much information may be obtained which is not biased by the results of previous work in the area.

The present practice of providing or partially providing constructs and elements is justified on the grounds that the object of the exercise was more to explore how various gambling and gambling related situations were interpreted by a group of social gamblers and non-gamblers. The underlying motivation was a secondary concern. Thus, depending on what is required the repertory grid technique can be easily adapted to suit the requirements of the study. It is concluded that the grid is a useful in gambling research and its use should be extended in future studies especially in the earlier stages of the investigation.

CHAPTER NINE

SUMMARY AND CONCLUSIONS

Personality characteristics of gamblers.

In the few investigations into the personality of gamblers the traits of an external locus of control and high neuroticism are the only ones that have been consistently identified in compulsive gamblers. The external locus of control orientation only appears to characterise compulsive gamblers but not social or other types of gamblers. It was observed that a very limited range of personality tests have been administered to gamblers which may explain why so few characteristics are associated with individuals who are involved with gambling. Futhermore, the multi-dimensionality of risk-taking and the existence of different types of gamblers have not been agreed on which makes the mapping of their characteristics and comparison between studies difficult. The study of social gamblers was argued to be important in formulating the theoretical nature of gambling and gamblers and the ignoration of this group seems to highlight weaknesses in some of the present theories of gambling, especially in terms of the motivational aspects, the reinforcing nature of the activity and why many members of this group never progress to become problematic gamblers.

Gambling, recall and locus of control

Monetary risk-taking has commonly been associated with an external control orientation. Presumably, gambling is largely a chance-determined activity which would be preferred by individuals with an external rather than internal control

orientation. To partially test this assumption, the risk-taking propensity of internal and external persons was investigated. In this study externals did not take higher risks than internals. The transitivity of gamblers being more external than non-gamblers and externals having a greater susceptibility to gambling than internals was questioned. From the available evidence it was proposed that pathological gamblers have a passive external orientation while social gamblers have a defensive external orientation. Occasional gamblers were suggested to be similar to non-gamblers except for a greater belief in chance and luck and non-gamblers to have a predominantly internal control orientation. The failure in recognising differences in these types of gamblers may have contributed to the inconclusiveness of the relationship between an affinity for gambling and an external locus of control.

The training and shaping of gamblers may be partly due to a selective encoding of winning compared to losing experiences in gambling. This was suggested to be related to a basic preservation of and/or an increase in self esteem. The unusually high optimism of social gamblers could also have arisen from having a memory base which is over-represented with winning events. Losses in gambling could have been discounted by social gamblers by treating them as a fee for participating in an enjoyable activity.

The recall data gave support to the fairly well established finding of over-estimating occurrences of infrequent events and under-estimating occurrences of frequent events. In this study, rather than the usual result of internals being more accurate than externals in recall tasks, both internals and externals were shown to be

inaccurate in estimating the appearances of dice numbers. Externals tended to over-estimate occurrences of infrequent events more than internals while both internals and externals tended to under-estimate occurrences of frequent events. In general, internals were more accurate in estimating the amount of money staked during the gambling session compared to externals but a sex interaction showed external males as being most accurate and external females least accurate with internal males and females in between. The differences in the socialisation of the two sexes and the greater experience in gambling matters were proposed to explain the disparity in the estimation performance.

Gambling and stimulus-binding

It was originally thought that the responses of gamblers, in general, may be stimulus-bound in a manner similar to the eating responses of obese individuals. The results of this study did not support such a hypothesis. The subjects not being heavy gamblers may have influenced the results. The other possible reason for the lack of stimulus-binding characteristics is that gamblers may not demonstrate complete stimulus-binding but only to stimuli that are related to gambling. It was suggested that if that was the case it would be more appropriate to use conditioning concepts, particularly discriminative stimuli and their properties of setting the occasion on which operant responses are reinforced and, at the same time, serving as reinforcers in a chain of events. This is most relevant considering that, in practice, the majority of gambling activities represent a series of repetitive sequential responses. It was also noted that cognitive factors should be included when

discussing gambling responses to get a more complete picture.

The probability, skill and chance perception and preferences of gamblers and non-gamblers.

Although risk is one of the most important aspects of gambling, frequently measured by the amount of money that is staked on a gamble, probability of payoffs and the amount of money to be won or lost, another interesting feature of gambling is the perception and the confidence of the chances of winning. Social gamblers were found to be consistent and non-gamblers inconsistent in their gambling decisions. The amount of money staked did not correspond to the perceived chances of winning for non-gamblers whereas the two measures matched fairly well for social gamblers which is to be expected if a rational strategy is employed. Rather than branding non-gamblers as irrational it was explained that non-gamblers were inconsistent due to a lack of experience in gambling.

In this study, social gamblers perceived that more skill was involved in a chance game than non-gamblers. Social gamblers preferred a more uncertain alternative than non-gamblers when there was a possibility of greater gain or loss. For choices with the same expected value social gamblers selected a lower probability of winning a bigger amount while non-gamblers chose those of a higher probability of winning a smaller amount of money. Social gamblers were also found to be more optimistic about their chances of winning in an on-coming gambling event than non-gamblers. All these findings were explained in terms of a faulty encoding system whereby in gamblers more winning than losing events were encoded over a period of time thus making success

subjectively more likely and also inducing a greater skill involvement.

The outcomes of previous bets have been shown to be influential in determining future gambling decisions. It was also mentioned that because winning and losing outcomes are closely associated the identification of the dominant control of either outcome is difficult. Related to the proposed explanation of a biased encoding system it was surmised that another difference between gamblers and non-gamblers may be that losses are more salient for non-gamblers while for gamblers wins are more influential.

Luck and superstition and gambling

One consistent finding in the present research is that social gamblers have a greater belief in luck than non-gamblers. Cohen's research showed that belief in luck decreases with age which implies that those who belief in luck may be less mature than those who do not. There was some support for the proposition that gamblers are less mature people from the constructions of gambling derived from the repertory grid technique. There was no difference in superstitious behaviour and attitudes about superstitions between social gamblers and non-gamblers. People tend to rate themselves as being luckier when they have experienced some positive events immediately prior to the time when the rating is made than when the positive events occurred some time before the rating. Females tended to rate themselves as being more unlucky than males when engaging in a chance game. Information on the status of luck that the individual may experience was shown to be influential in altering recall and estimation tasks and also in the amount of risk taken.

The main factor that associates gambling with luck and superstition is the uncertainty of the gambling situation. The many individual mannerisms which are performed by gamblers have probably evolved from associations with previous successes while other more common ones are probably transmitted from generation to generation. Some of the suggested functions of a belief in luck and superstition are: an aid in the decision-making process, a confidence booster, a reduction of cognitive dissonance and last but not least, a scapegoat for misfortune.

Reinforcement history, gambling cues and arousal.

The use of the terms gambler's fallacy and negative recency are discussed and it is suggested that in order to avoid confusion the following nomenclature be adopted. To reduce further ambiguity Jarvik's original use of the term gambler's fallacy is preserved. In the present classification when the choice of alternative is changed it is a fallacy. When it is the confidence that an event is going to have a particular outcome, that is altered as shown by the amount of money staked - large amount reflecting greater confidence and small amount reflecting lesser confidence - it is referred to as a recency effect. These two biases are further divided into the gambler's fallacy and the non-gambler's fallacy, and in the latter case, the negative recency effect and the positive recency effect. Since adopting any of these strategies for a period of time during a gambling session constitutes fallacious reasoning, all these four gambling decisions are considered to be gambling fallacies. These biases in responding were suggested to arise from a poor understanding of probability

and randomness of events.

Both the outcome of the preceding gambles and the ratio of the number of wins and losses have been shown to play a part in determining the betting strategy of people. The present results suggest that the ratio of wins and losses encountered interacts with the effect of preceding wins or losses. The gambling decisions of gamblers tended to be subjected to the negative recency effect while that of non-gamblers tended to be susceptible to the positive recency effect. Runs of either wins or losses increased the strength of the influence more than just individual winning or losing outcomes. The amount of money in hand and the amount of money won or lost do not seem to be important in the risk-taking decisions. In general, losses appear to be more influential in changing gambling decisions than wins. A distinction was drawn between the ratio of wins and losses and the probability of losing and perceived risk although the three are acknowledged to be closely related. The ratio of wins and losses probably alters the subjective probability of winning or losing thus changing the perceived risk of the gambling decisions. It was also asserted that using the gambling fallacies and recency effects to explain the behaviour of certain subjects was incomplete since one is still left with the question of why some subjects adopt the gambling fallacy strategy or are biased by recency effects. In this regard it was suggested that personality factors may be involved. The differences between social gamblers and non-gamblers in the amount of risk taken in gambling decisions provide further support to the influence of personality factors.

The reinforcement history affected more than just the

risk-taking behaviour of subjects. The trend was for a poor reinforcement schedule to lower the confidence of winning future gambles and in correctly predicting future outcomes but runs of payoffs and non-payoff gambles were also shown to be influential on such ratings. Generally, losing gambles decreased confidence while winning gambles increased confidence.

The use of gambling cues in many gambling situations by gambling establishments was shown to be pervasive although it may not be consciously noticed by others not involved in gambling. On the whole these attractions cater for the gambling fraternity but the novice who is interested may be enticed by these stimuli. In an experimental gambling situation social gamblers increased their risk-taking in the presence of gambling cues while the risk-taking was decreased in non-gamblers. The interpretion given was that gambling cues created a more realistic atmosphere for gamblers, setting the occasion for gambling, while for non-gamblers who have no experience of such situations, the increased realism may be aversive.

It has been shown, in many instances, that gamblers find gambling more exciting and enjoyable than non-gamblers. The reasons for such differences are yet unknown. It was suggested that part of the differences may have been a result of previous learning, with positive emotions such as thrill, excitement and, at times, monetary reinforcements associated with gambling. However, this still does not explain why some individuals are more inclined to participate in gambling to obtain these pleasures than others. The individual differences in the tonus level of arousal, the arousal threshold and the sensation-seeking propensity and the

associated U-shaped arousal curve were considered to be important factors in the acquisition of the interest in gambling. An indirect attempt was made to investigate the plausibility of such a hypothesis.

Different forms of arousal were found to have different effects on the gambling decisions of gamblers and non-gamblers with physical arousal having a lower potency than emotional arousal. The results must be treated with caution because there was no measure of how successful the arousal was induced in the subjects. In this vein, it was maintained that present measures of arousal only quantify the construct, and even then with difficulty - the most promising technique being the skin conductance measure. The robustness of the commonly used measure of arousal, heart-rate, was questioned. Qualifying arousal is still not feasible especially where such varied emotions have been known to be elicited in the gambler, from the placing of the stakes (for example, excitement and apprehension) and outcomes of gambles (for example, depression and joy). The evidence showed some support for the notion of the under-aroused gambler but much more research will be required to clarify the situation.

The repertory grid technique for studying gamblers and gambling.

Using the repertory grid technique, a number of previous results were supported and some new insights were provided. Social gamblers are interested in gambling and are aware of their involvement in the activity. It seems that social gamblers are willing to take monetary risks for a number of reasons. Monetary risk-taking is construed as a positive, socially admired behaviour, being associated with high

self-esteem, unconcerned with failure and as a gregarious activity. Money is not merely a means of gambling, as suggested by some investigators, but is important to social gamblers although only as a sign of successful confrontation against the system. Luck is seen as part of gambling and excitement but superstition is not at all associated with gambling.

It was noted that gambling need not necessarily be interpreted as a deviant behaviour and that there may be some merit in decribing gambling in positive terms. This is especially relevant since the majority of gamblers who engage in gambling for social reasons derive pleasure from their participation and do not suffer any negative consequences. The disadvantage is usually losing money which can be regarded as a payment for the entertainment although on some occasions more money is lost than was planned. There are a few positive aspects of gambling but these are usually overshadowed by the more negative consequences of over-indulgence in the activity.

As a bonus it was possible to compare the self and ideal self constructions of both the social gamblers and non-gamblers. For the self constructions, compared to non-gamblers, social gamblers like gambling more, take more risks, like excitement more, do things better in a group, show a greater need for achievement, are more superstitious, have a greater preference for uncertain outcomes, a higher belief in luck and are perceived to have a higher self-esteem. The remaining six constructs were rated similarly for the two groups. These are usually calm/ tends to worry, not concerned about failure/ fears failure, not aroused easily/ easily aroused, has a liberal/ conservative

outlook and is pessimistic/ is optimistic.

In the ideal self comparison of gamblers and non-gamblers, gamblers still prefer to gamble more, take more risks, like more excitement and need achievement more than non-gamblers. This shows that there may be some evidence of personality factors between the two groups since some of the differences are evident in both the self and ideal self constructions.

Overall, the repertory grid technique was useful in clarifying some features of gamblers and in providing some further insights into the construing of gamblers and gambling activity.

A sketch of the social gambler and proposals of some motivations for gambling.

Throughout the thesis the general concern has been to delineate the characteristics of mainly social gamblers in their personality and their behavioural and cognitive responses to gambling situations. On most occasions a control group of non-gamblers was given the same stimuli and performed the same tasks. As a consequence a number of interesting observations concerning the non-gambler subjects' attitudes towards and responses towards gamblers and gambling situations were noted.

Differences in personality and behavioural characteristics have already been discussed in the last chapter. The next task is to put together the results from this and other studies, to create a picture of the `average' social gambler, since most of the data obtained came from the subjects who only gamble `socially'.

In many respects the gambler is not very different from

the non-gambler and for that matter fairly similar to the pathological gambler as well. The social gambler enjoys gambling, and generally risks more than the non-gambler. In a gambling situation these gamblers are likely to be influenced to take more risks when gambling cues are present, as if they act like a catalyst. In this instance the catalyst may be more appropriately referred to as the discriminatory stimulus with its properties of initiating a response chain and providing reinforcements in the chain.

Generally, social gamblers risk more money after a loss but decrease their stakes when the previous outcome is a win, following the commonly named gambler's fallacy strategy of betting. It is suggested that the term negative recency effect is more unambiguous in describing such a pattern of responding although it is acknowledged that in a mainly chance-determined activity the strategy is also fallacious. The effect may reach its peak following a run of 3 similar outcomes whether favourable or unfavourable. The history of the number of wins and losses encountered as well as that of the immediately previous outcome or runs of the same outcome have a great influence on the staking behaviour of social gamblers and their confidence in their decisions. It seems that outcomes of gambles are taken as indicators of the future success as if having a favourable or unfavourable gambling session is, in a way, similar to experiencing runs of good or bad luck. Perhaps when social gamblers are unsure of the direction of luck previous outcomes may play a larger part in the gambling decisions. Some form of rationality is implied in that social gamblers are assumed to be searching for information so that they can be more successful in their gambling performance.

One striking characteristic of social gamblers is their confidence or optimism in gambling either in rating their chances of winning or in deciding the size of the stakes placed, perhaps because of the greater skill element perceived in the game. There is a large belief in luck but superstition is not associated with gambling. Having a bet or risk-taking is associated with socially desirable behaviours possibly as a means of gaining self-esteem. Related to this, associations of gambling with other social qualities valued by adolescents seem to present social gamblers as immature persons.

Social gamblers display more experience in the gambling task uniformly varying the amount of money bet, rating of the chances of winning and predicting the correct outcome. The acknowledgement of the greater influence of cues may also be a function of experience in gambling, associating it with feelings of thrill, joy, excitement and perhaps a sense of control over the environment felt on previous gambling occasions.

An integral part of the discussion of gambling should be some explanation of why people gamble. As has been mentioned before, there has been little success in attempting to explain gambling by one or two motivational drives. The approach should take into account as many aspects of the gambling behaviour as possible. Personal or situational factors, initiation or maintenance of gambling and the type and intensity of gambling are some of the areas which should be accounted for by any good explanation. Most of the existing theories of gambling have focussed on only limited aspects of gambling. At present it appears that an eclectic approach may be most successful in providing a comprehensive

theory of gambling.

It is reiterated that the gamblers described here are individuals who gamble occasionally, mainly for social purposes. It is tempting to suggest that part of the motivation of gambling for social gamblers is the pure joy of gambling. Many forms of gambling involve being in the company of people and a strange sort of unspoken comradeship often develops especially when the betting is primarily against the `system', as in horse-race betting. Being a winner boosts ones ego. There will not be many greater pleasures in everyday activities than in imparting this ability to those around and being applauded at the same time (Zola, 1963). Similarly, in the present study, an increase in self-esteem, derived from beating the system and being able to influence the environment in some way, appears to be another likely motivation. The other equally important reason for gambling includes the desire for thrill and excitement, and as a corollary, the avoidance of boredom. Most of the motivational factors mentioned above seem to involve a change in the level of arousal, usually an increase. From this observation it was proposed that gamblers are under-aroused individuals: sensation-seekers whose preferred form of arousal is gambling. Furthermore, the greater risks often taken by gamblers may be due to a higher threshold for arousal and, more obviously, to the learned effect of tolerance.

It is not the purpose of this study to discredit the role of learning theories or mathematical models in explaining gambling behaviour because once in the gambling situation, gambling decisions have been shown to have some consistency in responding, influenced by stimuli present. In

this vein, the importance of gambling cues functioning as discriminatory stimuli is emphasised. Other data showed that there may also be personality factors involved in explaining some of the gambling patterns. There is also little disagreement that different forms of gambling activities do not have the same risk factor or chance/skill involvement; thus different strategies are required in each case. Taking the variety of gambling activities and the diversity of decisions that are required into account it becomes clear that none of the existing theories is adequate in fully explaining gambling behaviour. This is especially obvious in the search for the motivational aspects of gambling and, at times, the maintenance of gambling. The proposed importance of social factors such as self-esteem, sense of well-being and achievement, and the attainment of physiological equilibrium suggests that an existential, hedonistic model of gambling may have merit.

CHAPTER TEN

DIRECTIONS FOR FUTURE RESEARCH

Gambling has been studied from many perspectives and there seems to be some merit in interpreting the behaviour in phenomenological terms. One way of doing this is by the use of the repertory grid technique where a large amount of data may be collected from an individual within a relatively short time. It is also adaptable for use in many varied situations. The other advantage, although one which may be queried by some investigators, stems from the freedom in interpretation of the data. In the face of its great versatility, supported by the present study, the use of the grid technique in the study of gambling behaviour should be further explored.

The present series of studies raise a number of interesting questions. The results of the arousal experiment indicated that arousal has some influence in the gambling behaviour of both social gamblers and non-gamblers. Different types of arousal were shown to have different effects. The two different forms of arousals induced were assumed to have different intensities of arousal. This meant that the differences could have arisen from either the type or the intensity of arousal that were induced or both. Thus it would be interesting to further investigate the effects of different forms of arousal, that is, emotional (psychological) and physiological, induced by either natural or chemical means. The measurement of arousal needs to be improved; the most satisfactory method, at present, seems to be a measurement of galvanic skin responses (Croyle & Cooper,

1983) and specifically skin conductance response (Barabasz, 1977). These arousal measurement techniques require the person to keep relatively stationary, so the nature of the gambling game would need to be modified accordingly such that the person making the gambling responses requires little bodily movement. Verbal responses such as those used in Ritchie's (1984) study would be an improvement over manual typing or even written responses.

We do not conclude that a jogger or squash player enjoys the activity because of the heightened arousal experienced during the event, so by the same token we should not too readily assume that the gambler gambles for the excitement because he/she is observed to be excited during gambling. In the jogger or squash player the motivations may include: getting fit for health, shaping up for cosmetic appeal, simply enjoying the activity, or obtaining the `runner's high'. Another motive may be to improve ones ability to win, gaining the admiration of others and increasing ones own self-esteem and self-efficacy. Similar motivations are suggested to be important in explaining the participation in gambling, especially for social gamblers. Although it is difficult to `prove' that these factors are relevant it is, nevertheless, important to follow up the possibility. Most of the existing descriptions of motivational and decisional aspects of gambling behaviour do not take these social factors into account and their inclusion will no doubt increase the predictive power of the more eclectic explanation of gambling behaviour. The ones that deserve further study include; self-esteem from beating the system or being a winner or being able to influence the situation, the pure joy of gambling and the role of the gambling activity as

a recreation.

On a more empirical level, the hypothesis that gamblers encode more success events than failure events should be tested. This proposition is interpreted as being related to the above constructs in that the bias towards retaining positive events may possibly reflect a deeper psychological state of insecurity, low self-esteem or low self-efficacy. A selective encoding system would therefore help to improve the existing psychological composure.

The relationship between social gamblers and locus of control is still unclear. Similarly, the significance of the need for achievement, sensation-seeking propensity and other personality factors in the gambling behaviour of social gamblers needs to be clarified. The present studies on the belief in luck, perceptions of skill and chance involvement in a situation and the amount of risk taken show fairly consistent inter-group differences indicating some stability in responding.

The relative importance of immediate reinforcements, that is, receiving payoffs from previous outcomes and that of the ratio of wins and losses encountered over a series of trials merits further investigation. Whether winning or losing is more influential in determining future staking behaviour and the eagerness for continued and/or future participation is also an interesting question. Phenomenological explanations would predict that winning is more important than losing because winning is reassurring for the self image. However, winning is important in economic theory because man is assumed to be rational and it would be logical to maximise utility. In a sense, losing may be more important from a learning theory perspective in that it is

intermittent reinforcements (which make up the number of non-reinforced gambles and their positions of occurrences) that encourage and maintain maximum participation in gambling activity. Losing may also be interpreted to have effects which are different from simple punishment.

From a cognitive perspective, losing money can induce a strong determination in the individual to recoup losses. Similarly, runs of good luck may create a sense of omnipotence leading to more and more unreasonable risk-taking, when unrestrained, inevitably leads to financial disaster. Few economic or any other accounts of gambling take these probable influences into consideration. Inclusion of such cognitive influences into a theory of gambling behaviour will improve its predictive properties.

Finally, the contribution of the environment and the influence of situational factors to gambling behaviour is also acknowledged. It was shown that gambling behaviour is not completely stimulus-bound but is affected by gambling related cues. Gambling cues or situational cues that are associated with gambling activity seem to influence the betting behaviour of social gamblers and non-gamblers in different ways. It may be illuminating (for gambling enterpreneurs) to chart the specific influences of different media of presentation of rewards and stimulus cues which are associated with payoffs in the gambling sequence.

Like many research projects more questions are generated by this thesis than answers provided. The search for a better description and explanation of gambling behaviour by social gamblers and non-gamblers will hopefully lead to a better understanding of the factors involved in the activity and the reasons the individual may have for engaging in it.

Like most other behaviours, it is becoming clearer that a more eclectic approach to the study of gambling may be the most fruitful course to take.

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Name: _____ Score : _____

QUESTIONNAIRE ON GAMBLING BEHAVIOUR

Gamblers Anonymous Gambling Questionnaire

1. Do you lose time from work due to gambling? (Yes-No)
2. Is gambling making your home life unhappy? (Yes-No)
3. Is gambling affecting your reputation? (Yes-No)
4. Have you ever felt remorse after gambling? (Yes-No)
5. Do you ever gamble to get money with which to pay debts or to otherwise solve financial difficulties? (Yes-No)
6. Does gambling cause a decrease in your ambition or efficiency? (Yes-No)
7. After losing do you feel you must return as soon as possible and win back your losses? (Yes-No)
8. After a win do you have a strong urge to return and win more? (Yes-No)
9. Do you often gamble until your last dollar is gone? (Yes-No)
10. Do you ever borrow to finance your gambling? (Yes-No)
11. Have you ever sold any real or personal property to finance gambling? (Yes-No)
12. Are you reluctant to use "gambling money" for normal expenditures? (Yes-No)
13. Does gambling make you careless of the welfare of your family? (Yes-No)
14. Do you ever gamble longer than you had planned? (Yes-No)
15. Do you ever gamble to escape worry or trouble? (Yes-No)
16. Have you ever committed, or considered committing, an illegal act to finance gambling? (Yes-No)
17. Does gambling cause you to have difficulty in sleeping? (Yes-No)
18. Do arguments, disappointments or frustrations create within you an urge to gamble? (Yes-No)
19. Do you have an urge to celebrate any good fortune by a few hours of gambling? (Yes-No)
20. Have you ever considered self destruction as a result of your gambling? (Yes-No)

UNIVERSITY OF CANTERBURY DEPARTMENT OF PSYCHOLOGY

QUESTIONNAIRE ON GAMBLING BEHAVIOUR

The purpose of this questionnaire is to survey the gambling activities of students and non-students to enable the selection of subjects for experiments which will study the personality characteristics of different groups of people. The information given here will be considered confidential. Please be as accurate as possible and answer every question, as an incomplete form is useless for scientific purposes. If you have any questions, please ask the person administering the questionnaire.

Sex: _____ Age: _____ Ethnic Background: _____

Nationality: _____

For non-students. Occupation _____ Salary (p.a.) _____

1. How long was it since you last gambled (betted)?

   _____ months _____ days

   _____ weeks _____ hours

2. How much money did you gamble (bet) in total? $_____

3. Where did you gamble (place your bets)? (Circle one)

   (a) At home
   (b) At a friend's place
   (c) At a race-course
   (d) At a race-course away from resident city.
   (e) At a TAB
   (f) Using a telephone account
   (g) Other
   Specify _____

4. Would you gamble (bet) the above amount of money

   (a) Nearly every time
   (b) More than half the time
   (c) Less than half the time
   (d) Once in a while

5. How long was it since you last gambled (betted) previous to the last time (the occasion referred to above)?

   _____ months _____ days

   _____ weeks _____ hours

6. How much money did you gamble (bet) in total? $_____

7. Where did you gamble (place your bets)?

   (a) At home
   (b) At a friend's place
   (c) At a race-course
   (d) At a race-course away from resident city.
   (e) At a TAB
   (f) Using a telephone account
   (g) Other
   Specify _____

P.T.O.

8. Would you gamble (bet) the above amount of money

(a) Nearly every time
(b) More than half the time
(c) Less than half the time
(d) Once in a while

9. How frequently do you gamble (bet)?

(a) Two or more times a day
(b) Every day or nearly every day
(c) Three or four times a week
(d) Two or three times a month
(f) About once a month
(g) At least once a year
(h) Less than once a year

10. In the spaces provided please fill in the amounts of money gambled (betted) over the past week?

SUNDAY	Lottery (specify)	_____	THURSDAY	Racing (horses,dogs)	_____
	Cards (poker etc)	_____		Cards (poker etc.)	_____
	Others (specify)	_____		Lottery (specify)	_____
				Others (specify)	_____
MONDAY	Racing (horses,dogs)	_____	FRIDAY	Racing (horses,dogs)	_____
	Cards (poker etc.)	_____		Cards (poker etc.)	_____
	Lottery (specify)	_____		Lottery (specify)	_____
	Others (specify)	_____		Others (specify)	_____
TUESDAY	Racing (horses,dogs)	_____	SATURDAY	Racing (horses,dogs)	_____
	Cards (poker etc.)	_____		Cards (poker etc.)	_____
	Lottery (specify)	_____		Lottery (specify)	_____
	Others (specify)	_____		Others (specify)	_____
WEDNESDAY	Racing (horses,dogs)	_____			
	Cards (poker etc.)	_____			
	Lottery (specify)	_____			
	Others (specify)	_____			

Thank you for your help. If you would like to take part in some experiments and complete a few questionnaires studying the personality characteristics of different groups of people, would you please write your name and telephone number.

Name: _____ Telephone No. _____

Suitable times: (List) _____

_____

The univariate F-tests of the factors in the 16 PF, EPQ and the Rotter's I-E Scale.

VARIABLE	DF	MS	F	P=
A - Reserved/Outgoing	2,42	2.14	0.85	0.437
B - Less/More intelligent	2,42	3.44	1.13	0.333
C - Aff by feelings/E stable	2,42	4.19	1.26	0.295
E - Humble/Assertive	2,42	2.15	0.44	0.649
F - Sober/Happy-go-lucky	2,42	5.30	1.46	0.244
G - Expedient/Conscientious	2,42	0.02	0.00	0.996
H - Shy/Venturesome	2,42	2.79	0.71	0.499
I - Tough-/Tender-minded	2,42	0.39	0.14	0.868
L - Trusting/Suspicious	2,42	1.17	0.31	0.733
M - Practical/Imaginative	2,42	3.43	0.77	0.471
N - Forthright/Astute	2,42	0.60	0.15	0.864
O - Self-assured/Apprehensive	2,42	4.34	0.98	0.385
Q1- Conservat./Experimenting	2,42	12.16	2.76	0.075
Q2- Group-depend./Self-suff.	2,42	3.42	0.99	0.380
Q3- Self-conflict/Controlled	2,42	7.20	2.05	0.141
Q4- Relaxed/Tense	2,42	6.76	1.82	0.174
P - Psychoticism	2,47	15.54	1.80	0.177
E - Introversion/Extraversion	2,47	10.21	0.47	0.628
N - Neuroticism	2,47	127.56	4.50	0.016
L - Lie	2,47	36.29	1.49	0.237
R - Rotter's I-E	2,46	54.47	2.99	0.060

APPENDIX 4

MANOVA output table for the EPQ data and ONEWAY ANOVA output table for the Rotter's I-E Scale data.

VARIABLE V18 P
BY VARIABLE GAM

ANALYSIS OF VARIANCE

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
BETWEEN GROUPS	2	31.0873	15.5437	1.798	0.1768
WITHIN GROUPS	47	406.2926	8.6445		
TOTAL	49	437.3799			

VARIABLE V19 E
BY VARIABLE GAM

ANALYSIS OF VARIANCE

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
BETWEEN GROUPS	2	20.4159	10.2079	0.470	0.6278
WITHIN GROUPS	47	1020.3045	21.7086		
TOTAL	49	1040.7202			

VARIABLE V20 N
BY VARIABLE GAM

ANALYSIS OF VARIANCE

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
BETWEEN GROUPS	2	255.1199	127.5599	4.504	0.0162
WITHIN GROUPS	47	1331.2000	28.3234		

VARIABLE V21 L
BY VARIABLE GAM

ANALYSIS OF VARIANCE

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
BETWEEN GROUPS	2	72.5709	36.2854	1.486	0.2368
WITHIN GROUPS	47	1147.9284	24.4240		
TOTAL	49	1220.4990			

VARIABLE V22 ROTTER'S I-E
BY VARIABLE GAM

ANALYSIS OF VARIANCE

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROB.
BETWEEN GROUPS	2	108.9395	54.4697	2.991	0.0601
WITHIN GROUPS	46	837.8363	18.2138		
TOTAL	48	946.7758			

APPENDIX 5

Payoff schedules in the 7 blocks of trials

CONDITION 1

DICE	TRIALS 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	x	x	2	2	1	6	3	x	x	x	3	x	3	2	4
2	4	6	6	2	5	2	6	x	4	3	1	x	4	1	4
3	6	6	6	5	2	2	6	6	6	3	3	6	1	3	3

CONDITION 2

DICE	TRIALS 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	1	6	x	x	1	x	x	6	x	x	5	x	3	5	x
2	5	3	2	x	4	2	6	3	4	x	4	1	6	5	x
3	3	1	4	1	3	5	6	1	1	6	6	6	6	5	5

CONDITION 3

DICE	TRIALS 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	2	x	x	1	5	4	6	4	2	4	4	x	x	x	2
2	5	x	2	2	5	1	1	4	2	4	4	3	6	2	1
3	1	6	4	2	6	5	3	2	4	6	3	3	4	1	4

CONDITION 4

DICE	TRIALS 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	4	3	1	x	2	5	2	x	x	2	x	x	x	3	x
2	1	5	2	x	6	1	2	1	3	2	1	6	1	5	5
3	4	1	4	2	5	2	2	5	2	3	1	4	6	5	5

CONDITION 5

DICE	TRIALS 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	2	x	2	x	3	3	3	x	x	x	3	x	1	6	x
2	5	4	2	x	3	3	6	3	3	4	6	1	4	3	2
3	1	6	2	2	4	4	5	3	6	4	5	2	1	5	2

CONDITION 6

DICE	TRIALS 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	x	2	6	4	2	5	x	x	6	x	x	x	4	x	x
2	x	1	5	2	2	4	5	2	2	4	x	3	6	6	x
3	2	2	2	4	4	2	5	5	1	1	1	1	4	4	6

CONDITION 7

DICE	TRIALS 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	1	1	6	x	6	3	x	x	4	6	x	6	4	x	3
2	5	6	6	1	1	3	x	2	4	6	1	3	1	1	6
3	5	6	6	2	6	3	5	3	5	4	5	6	3	5	1

APPENDIX 6

Choice of stakes and numbers.

Trial	BLOCK 1		BLOCK 2		BLOCK 3		BLOCK 4	
	STAKE	NO.	STAKE	NO.	STAKE	NO.	STAKE	NO.
1	14-18	5-1	1- 5	6-4	7-11	6-3	6- 2	2-6
2	13-17	4-1	12-16	5-2	6-10	2-4	1- 5	6-4
3	9-13	4-3	8- 4	3-5	15-19	6-1	11-15	6-3
4	15-19	4-6	3- 7	6-5	17-13	6-3	18-14	3-5
5	14-10	3-6	14-10	6-5	4- 8	4-2	13-17	3-1
6	8- 4	1-4	14-18	6-4	11-15	6-2	12-16	6-3
7	6- 2	5-2	9-13	1-3	6- 2	2-4	5- 9	6-3
8	6-10	4-3	7-11	4-2	14-18	5-6	8- 4	6-3
9	5- 1	1-5	12- 8	6-5	14-10	6-1	9-13	4-6
10	3- 7	6-5	17-13	3-4	16-12	5-2	10-14	1-4
11	11- 7	6-5	9- 5	3-1	3- 7	6-2	8-12	5-2
12	9- 5	3-4	15-19	4-5	5- 1	4-1	3- 7	1-3
13	12-16	2-6	11-15	2-4	9-13	2-5	7-11	4-2
14	8-12	5-4	10- 6	3-2	12- 8	5-3	15-19	2-4
15	15-11	2-1	6- 2	4-6	9- 5	6-5	6-10	3-4

Trial	BLOCK 5		BLOCK 6		BLOCK 7	
	STAKE	NO.	STAKE	NO.	STAKE	NO.
1	5- 1	4-6	13-17	1-4	10-14	6-2
2	10-14	1-5	15-11	6-5	10- 6	4-3
3	2- 6	3-6	18-14	3-4	13- 9	1-2
4	11- 7	3-5	12-16	1-3	15-11	3-6
5	15-11	2-5	12- 8	1-6	13-17	2-5
6	7- 3	1-5	2- 6	3-6	8-12	2-5
7	12-16	2-4	1- 5	1-6	12-16	6-4
8	4- 8	1-6	19-15	6-3	2- 6	1-5
9	13-17	4-5	3- 7	5-3	11- 7	6-1
10	13- 9	3-6	9- 5	3-2	1- 5	2-3
11	5- 9	2-4	11- 7	3-5	5- 9	4-6
12	6- 2	5-6	6-10	5-6	18-14	4-2
13	14-18	6-3	14-10	5-3	13- 9	2-6
14	8-12	1-4	8- 4	3-2	8- 4	2-4
15	6-10	6-5	9-13	5-1	3- 7	4-5

APPENDIX 7

Response sheet for the choice of numbers and the total amount staked in blocks of 5 trials

List the 5 numbers that you think you chose in each of the block segments of the sheet below (if you are uncertain, guess). Underneath, list the total amount of money that you think you bet on the numbers in those 5 trials.

	1st 5 choices	2nd 5 choices	3rd 5 choices
BLOCK 1			
	cents	cents	cents
BLOCK 2			
	cents	cents	cents
BLOCK 3			
	cents	cents	cents
BLOCK 4			
	cents	cents	cents
BLOCK 5			
	cents	cents	cents
BLOCK 6			
	cents	cents	cents
BLOCK 7			
	cents	cents	cents

APPENDIX 8

Response sheet for the estimated number of throws of dice, amount of money won/lost and replies to probe questions.

Subject's name _____ I-E score ____

Estimated number of throws of dice

	BLOCK-1	BLOCK-2	BLOCK-3	BLOCK-4	BLOCK-5	BLOCK-6	BLOCK-7
1	_____	_____	_____	_____	_____	_____	_____
2	_____	_____	_____	_____	_____	_____	_____
3	_____	_____	_____	_____	_____	_____	_____
4	_____	_____	_____	_____	_____	_____	_____
5	_____	_____	_____	_____	_____	_____	_____
6	_____	_____	_____	_____	_____	_____	_____

Estimated amount of money won/lost (cents)

BLOCK-1	BLOCK-2	BLOCK-3	BLOCK-4	BLOCK-5	BLOCK-6	BLOCK-7
_____	_____	_____	_____	_____	_____	_____

Answers to probe questions.

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

Further comments.

_____

_____

_____

APPENDIX 9

Post-experiment questionnaire (verbal administration)

1. Do you consider this a skill game or a chance game?

chance 1 ---------- 10 skill

2. Do you think you were lucky or unlucky?

unlucky 1 ---------- 10 lucky

3. Do you think there was any change in the probability of each outcome?

yes/ no

4. Do you think you could win more given more time?

yes/ no

5. Are you satisfied with the game as a game?

very dissatisfied 1 --- 10 very satisfied

6. Did you enjoy the game?

not at all 1 ---------- 10 very much

APPENDIX 10

ANOVA output table of the higher stakes chosen.

SOURCE	DEGREES OF FREEDOM	MEAN SQUARE	F	p =
LOC	1	85.71	2.38	0.136
SEX	1	97.52	2.71	0.113
L x S	1	0.02	0.00	0.980
ERROR	24	36.00		
INFORMATION	1	0.60	0.18	0.678
I x L	1	0.10	0.03	0.868
I x S	1	3.43	1.02	0.323
I x L x S	1	0.02	0.01	0.934
ERROR	24	3.37		
FORTUNE	2	40.04	10.49	0.0002
F x L	2	21.13	5.53	0.007
F x S	2	0.11	0.03	0.971
F x L x S	2	0.08	0.02	0.980
ERROR	48	3.82		
I x F	2	33.15	5.92	0.005
I x F x L	2	5.90	1.05	0.357
I x F x S	2	0.55	0.10	0.906
I x F x L x S	2	9.04	1.62	0.210
ERROR	48	5.60		

ANOVA output table of the recall of numbers chosen by subjects to place their bets on.

	SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE	F	TAIL PROB.
	MEAN	109.44017	1	109.44017	2405.25	0.0000
	LOC	0.00617	1	0.00617	0.14	0.7159
	SEX	0.01920	1	0.01920	0.42	0.5221
	LS	0.00781	1	0.00781	0.17	0.6823
1	ERROR	1.09201	24	0.04550		
	W	0.03241	1	0.03241	0.82	0.3743
	WL	0.08234	1	0.08234	2.08	0.1619
	WS	0.00080	1	0.00080	0.02	0.8877
	WLS	0.08048	1	0.08048	2.04	0.1666
2	ERROR	0.94893	24	0.03954		
	I	0.02679	1	0.02679	0.75	0.3955
	IL	0.05452	1	0.05452	1.52	0.2290
	IS	0.01263	1	0.01263	0.35	0.5580
	ILS	0.00220	1	0.00220	0.06	0.8062
3	ERROR	0.85876	24	0.03578		
	WI	0.30120	1	0.30120	11.07	0.0028
	WIL	0.01520	1	0.01520	0.56	0.4621
	WIS	0.00058	1	0.00058	0.02	0.8855
	WILS	0.01190	1	0.01190	0.44	0.5147
4	ERROR	0.65322	24	0.02722		
	F	0.27451	2	0.13725	4.58	0.0152
	FL	0.12800	2	0.06400	2.13	0.1295
	FS	0.01555	2	0.00778	0.26	0.7727
	FLS	0.05384	2	0.02692	0.90	0.4143
5	ERROR	1.43973	48	0.02999		
	WF	0.06577	2	0.03288	0.89	0.4162
	WFL	0.05168	2	0.02584	0.70	0.5008
	WFS	0.04553	2	0.02276	0.62	0.5432
	WFLS	0.00890	2	0.00445	0.12	0.8865
6	ERROR	1.76795	48	0.03683		
	IF	0.31771	2	0.15886	5.19	0.0091
	IFL	0.01631	2	0.00816	0.27	0.7671
	IFS	0.02466	2	0.01233	0.40	0.6705
	IFLS	0.04083	2	0.02042	0.67	0.5177
7	ERROR	1.46838	48	0.03059		
	WIF	0.00043	2	0.00022	0.01	0.9939
	WIFL	0.01705	2	0.00853	0.24	0.7854
	WIFS	0.43993	2	0.21996	6.26	0.0038
	WIFLS	0.03859	2	0.01929	0.55	0.5809
8	ERROR	1.68550	48	0.03511		

ANOVA output table of the recall of the most frequently occurring number.

SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE	F	TAIL PROB.
MEAN	1974.85714	1	1974.85714	100.77	0.0000
LOC	8.59524	1	8.59524	0.44	0.5141
SEX	4.02381	1	4.02381	0.21	0.6545
LS	54.85714	1	54.85714	2.80	0.1073
ERROR	470.33333	24	19.59722		
I	17.35714	1	17.35714	2.71	0.1130
IL	54.85714	1	54.85714	8.55	0.0074
IS	0.00000	1	0.00000	0.00	1.0000
ILS	1.16667	1	1.16667	0.18	0.6736
ERROR	153.95238	24	6.41468		
F	8.71429	2	4.35714	0.54	0.5837
FL	14.33333	2	7.16667	0.90	0.4151
FS	2.04762	2	1.02381	0.13	0.8802
FLS	8.14286	2	4.07143	0.51	0.6044
ERROR	384.09524	48	8.00198		
IF	21.14286	2	10.57143	1.19	0.3133
IFL	8.14286	2	4.07143	0.46	0.6353
IFS	0.57143	2	0.28571	0.03	0.9684
IFLS	42.04762	2	21.02381	2.36	0.1048
ERROR	426.76190	48	8.89087		

ANOVA output table of the recall of the least frequently occurring number.

	SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE	F	TAIL PROB.
	MEAN	1694.17286	1	1694.17286	226.22	0.0000
	LOC	71.04143	1	71.04143	9.49	0.0053
	SEX	1.75000	1	1.75000	0.23	0.6334
	LS	0.51571	1	0.51571	0.07	0.7953
1	ERROR	172.25000	23	7.48913		
	I	0.09921	1	0.09921	0.02	0.8930
	IL	5.91254	1	5.91254	1.10	0.3046
	IS	8.17921	1	8.17921	1.53	0.2293
	ILS	14.19063	1	14.19063	2.65	0.1174
2	ERROR	123.32937	23	5.36215		
	F	28.56286	2	14.28143	2.96	0.0617
	FL	26.33429	2	13.16714	2.73	0.0757
	FS	1.29429	2	0.64714	0.13	0.8747
	FLS	11.45429	2	5.72714	1.19	0.3141
3	ERROR	221.78571	46	4.82143		
	IF	3.65175	2	1.82587	0.27	0.7659
	IFL	2.94698	2	1.47349	0.22	0.8061
	IFS	3.40032	2	1.70016	0.25	0.7800
	IFLS	1.81175	2	0.90587	0.13	0.8757
4	ERROR	313.03968	46	6.80521		

ANOVA output table of the accuracy of estimation of the amount of money staked.

SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARE	F	TAIL PROB.
MEAN	17442.56944	1	17442.56944	16.27	0.0010
LOC	5057.31303	1	5057.31303	4.72	0.0452
SEX	3258.33868	1	3258.33868	3.04	0.1005
LS	719.49252	1	719.49252	0.67	0.4247
ERROR	17153.02778	16	1072.18924		
L	154.74380	1	154.74380	0.41	0.5329
LL	267.55577	1	267.55577	0.70	0.4143
LS	43.07714	1	43.07714	0.11	0.7410
LLS	24.55577	1	24.55577	0.06	0.8028
ERROR	6094.71667	16	380.91979		
F	1955.82735	2	977.91368	1.82	0.1783
FL	1408.34017	2	704.17009	1.31	0.2836
FS	1275.26325	2	637.63162	1.19	0.3181
FLS	650.18632	2	325.09316	0.61	0.5520
ERROR	17185.82222	32	537.05694		
TT	620.02735	2	310.01368	1.10	0.3455
TTL	102.72821	2	51.36410	0.18	0.8344
TTS	105.59145	2	52.79573	0.19	0.8302
TTLS	107.72821	2	53.86410	0.19	0.8271
ERROR	9026.73333	32	282.08542		

APPENDIX 15

ANOVA output table of the accuracy of estimation of the amount of money won/lost.

SOURCE	DEGREES OF FREEDOM	MEAN SQUARE	F	p =
LOCUS	1	255.1	0.11	0.741
SEX	1	4641.0	2.03	0.167
L x S	1	10355.7	4.53	0.044
ERROR	24	2287.8		
INFORMATION	1	5027.1	5.53	0.027
I x L	1	255.1	0.28	0.601
I x S	1	226.3	0.25	0.622
I x L x S	1	621.0	0.68	0.417
ERROR	24	908.7		
FORTUNE	2	21209.2	17.94	0.000
F x L	2	2095.1	1.77	0.181
F x S	2	200.5	0.17	0.845
F x L x S	2	371.5	0.31	0.732
ERROR	48	1182.1		
I x F	2	5064.9	5.20	0.009
I x F x L	2	153.5	0.16	0.855
I x F x S	2	1233.9	1.27	0.291
I x F x L x S	2	1087.6	1.12	0.336
ERROR	48	973.6		

```
0* * * * * * * * * * * * * * * * * * *  C R O S S T A B U L A T I O N   O F   * * * *
     Q3                                                          BY  LOC
 * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *


                    LOC
           COUNT  I
           ROW PCT IHIGH      LOW          ROW
           COL PCT I                       TOTAL
           TOT PCT I      1   I      2    I
Q3         --------I--------I--------I
                1  I      6   I      5    I    11
                   I  54.5   I  45.5   I  39.3
                   I  42.9   I  35.7   I
                   I  21.4   I  17.9   I
                  -I--------I--------I
                2  I      8   I      9    I    17
                   I  47.1   I  52.9   I  60.7
                   I  57.1   I  64.3   I
                   I  28.6   I  32.1   I
                  -I--------I--------I
           COLUMN        14         14        28
            TOTAL      50.0       50.0     100.0


 CORRECTED CHI SQUARE =      0.00000 WITH 1 DEGREE OF FREEDOM.  SIGNIFICANCE =  1.0000
       RAW CHI SQUARE =      0.14973 WITH 1 DEGREE OF FREEDOM.  SIGNIFICANCE =  0.6988
0* * * * * * * * * * * * * * * * * * *  C R O S S T A B U L A T I O N   O F   * * * *
     Q3                                                          BY  SEX
 * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *


                    SEX
           COUNT  I
           ROW PCT IFEMALE   MALE         ROW
           COL PCT I                      TOTAL
           TOT PCT I      1   I      2    I
Q3         --------I--------I--------I
                1  I      7   I      4    I    11
                   I  63.6   I  36.4   I  39.3
                   I  50.0   I  28.6   I
                   I  25.0   I  14.3   I
                  -I--------I--------I
                2  I      7   I     10    I    17
                   I  41.2   I  58.8   I  60.7
                   I  50.0   I  71.4   I
                   I  25.0   I  35.7   I
                  -I--------I--------I
           COLUMN        14         14        28
            TOTAL      50.0       50.0     100.0


CORRECTED CHI SQUARE =      0.59893 WITH 1 DEGREE OF FREEDOM.  SIGNIFICANCE =  0.4390
      RAW CHI SQUARE =      1.34739 WITH 1 DEGREE OF FREEDOM.  SIGNIFICANCE =  0.2457
```

Chi square analysis of Question 4.

Q4 BY LOC

* *

Q4	COUNT / ROW PCT / COL PCT / TOT PCT	LOC HIGH (1)	LOC LOW (2)	ROW TOTAL
1		4	5	9
		44.4	55.6	32.1
		28.6	35.7	
		14.3	17.9	
2		10	9	19
		52.6	47.4	67.9
		71.4	64.3	
		35.7	32.1	
COLUMN TOTAL		14	14	28
		50.0	50.0	100.0

2 OUT OF 4 (50.0%) OF THE VALID CELLS HAVE EXPECTED CELL FREQUENCY LESS THAN 5.0.
MINIMUM EXPECTED CELL FREQUENCY = 4.500
CORRECTED CHI SQUARE = 0.00000 WITH 1 DEGREE OF FREEDOM. SIGNIFICANCE = 1.0000
RAW CHI SQUARE = 0.16374 WITH 1 DEGREE OF FREEDOM. SIGNIFICANCE = 0.6857

0* * * * * * * * * * * * * * * * * * * C R O S S T A B U L A T I O N O F * * * * * * * *
Q4 BY SEX

* *

Q4	COUNT / ROW PCT / COL PCT / TOT PCT	SEX FEMALE (1)	SEX MALE (2)	ROW TOTAL
1		5	4	9
		55.6	44.4	32.1
		35.7	28.6	
		17.9	14.3	
2		9	10	19
		47.4	52.6	67.9
		64.3	71.4	
		32.1	35.7	
COLUMN TOTAL		14	14	28
		50.0	50.0	100.0

2 OUT OF 4 (50.0%) OF THE VALID CELLS HAVE EXPECTED CELL FREQUENCY LESS THAN 5.0.
MINIMUM EXPECTED CELL FREQUENCY = 4.500
CORRECTED CHI SQUARE = 0.00000 WITH 1 DEGREE OF FREEDOM. SIGNIFICANCE = 1.0000
RAW CHI SQUARE = 0.16374 WITH 1 DEGREE OF FREEDOM. SIGNIFICANCE = 0.6857

APPENDIX 18

* * * * * * * * * * A N A L Y S I S O F V A R I A N C E * * *

Q1
BY LOC
SEX

* *

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	1.214	2	0.607	0.277	0.760
LOC	0.321	1	0.321	0.147	0.705
SEX	0.893	1	0.893	0.408	0.529
2-WAY INTERACTIONS	2.893	1	2.893	1.321	0.262
LOC SEX	2.893	1	2.893	1.321	0.262
EXPLAINED	4.107	3	1.369	0.625	0.606
RESIDUAL	52.571	24	2.190		
TOTAL	56.679	27	2.099		

Q2
BY LOC
SEX

* *

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	13.857	2	6.929	7.462	0.003
LOC	2.286	1	2.286	2.462	0.130
SEX	11.571	1	11.571	12.462	0.002
2-WAY INTERACTIONS	2.286	1	2.286	2.462	0.130
LOC SEX	2.286	1	2.286	2.462	0.130
EXPLAINED	16.143	3	5.381	5.795	0.004
RESIDUAL	22.286	24	0.929		
TOTAL	38.429	27	1.423		

Q3
BY LOC
SEX

* *

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	3.786	2	1.893	0.677	0.518
LOC	0.893	1	0.893	0.319	0.577
SEX	2.893	1	2.893	1.034	0.319
2-WAY INTERACTIONS	6.036	1	6.036	2.157	0.155
LOC SEX	6.036	1	6.036	2.157	0.155
EXPLAINED	9.821	3	3.274	1.170	0.342
RESIDUAL	67.143	24	2.798		
TOTAL	76.964	27	2.851		

Q6
BY LOC
SEX

* *

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	0.143	2	0.071	0.017	0.984
LOC	0.000	1	0.000	0.000	1.000
SEX	0.143	1	0.143	0.033	0.857
2-WAY INTERACTIONS	2.286	1	2.286	0.530	0.473
LOC SEX	2.286	1	2.286	0.530	0.473
EXPLAINED	2.429	3	0.810	0.188	0.904

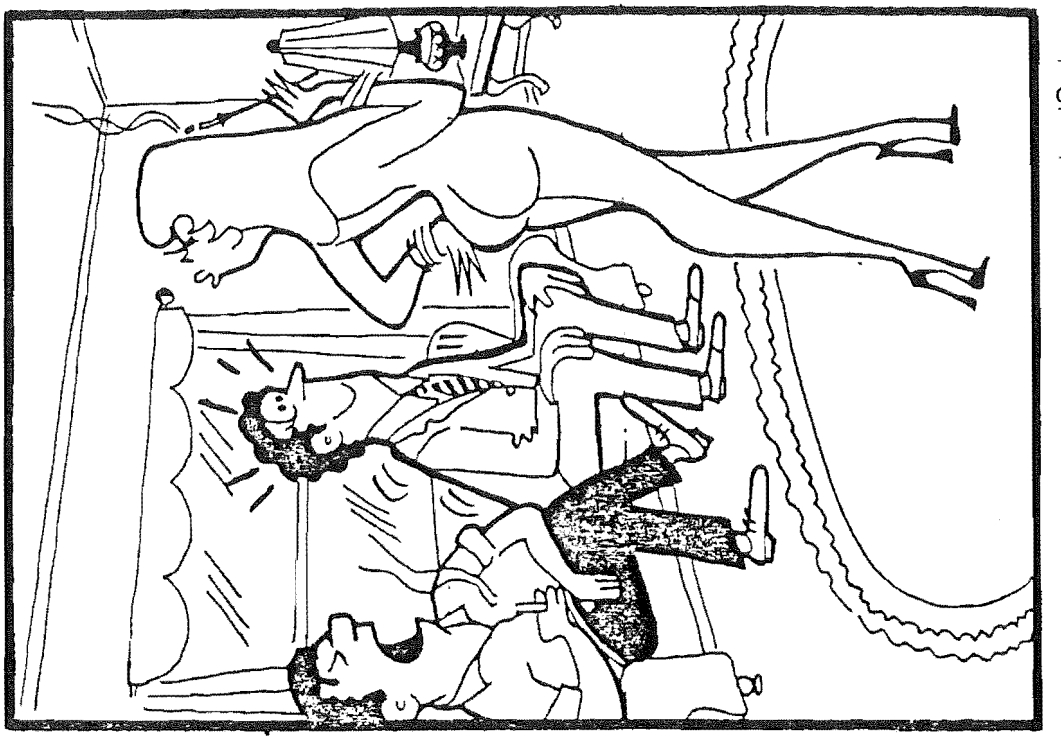
APPENDIX 19

Random alphabet matrix.

Name: _____

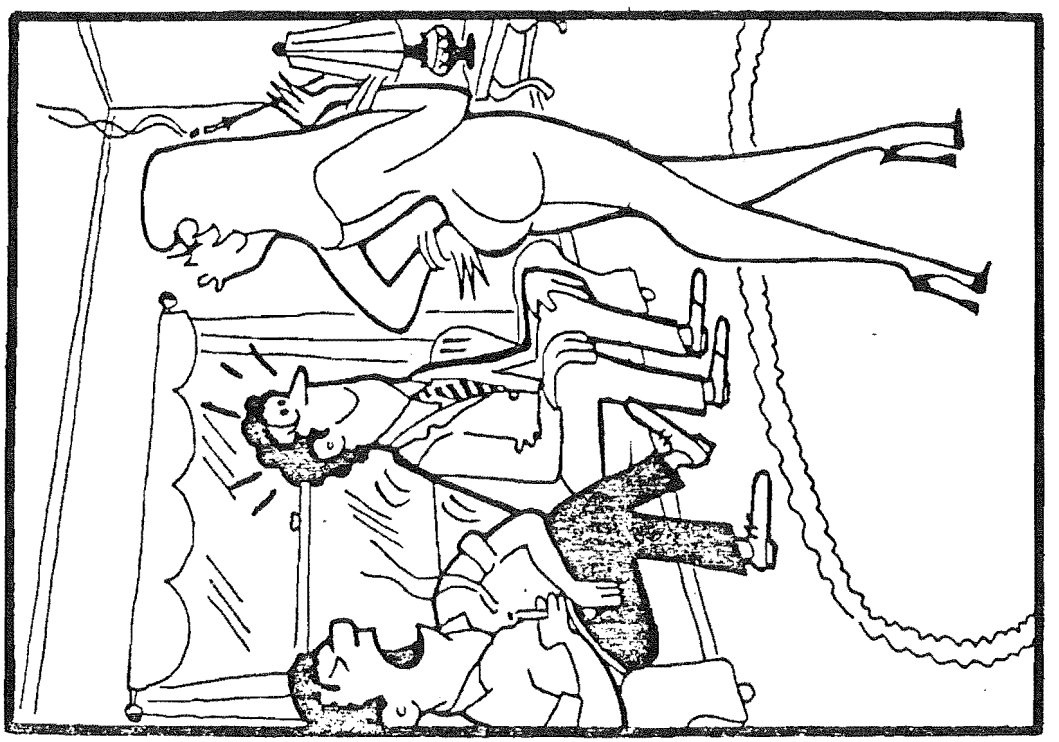
CCXGAGHRPAJVICAOBWXWJXCDXEINLY
UXONLMUUDNTZNPPRYYZMUYKBNZUUDL
UXVTBAIZZJDCYZADBQMUQFZTRPXYOX
EBNXBANSKVMVJKMGWKTNTAOHFACYMT
UKURWETWTCVMJYKSVAZGZZZDAHODHY
WSGKHCDRITHRAAUJHIRHIUVXPWHLZN
HXNEPACOVCKCNJNDNYWZHVJJNZUPKB
ESLQSLKXIGDAYYIBWJUDOFUJINCEMZ
RNDXMKNOVEODJSJNQJIRFBXFRTVGIB
HLCXEVQGAXQLWFSXVCSOEFFXJXFOXL
YAGQRDOHLQUOJSNYXTPPGIXLOHGVHP
DEPLCPEMSSBSQJBHALJSFCJMNCKBAD
KVKFUVYFRAUIVJVDBMGWFEBOTKKORZ
AUMNLRHBWTDWNSDPWFWIXBDBZXRFNB
KBCBXETHUXIOXSGTZLYYAJBIDCYPYW
ZKMSONTUXUWSICELSDGQUIYAGTSUNA
OOEKCLGBWYJOHNDHYLTNWNDPFTKVNM
UNRRNVHCAFCNRSCFUQMZUFSUBSZFRB
STQMDLACNFDMJRXMNQUVGBFMXYNTGZ
XTESEHNOJYTIJKBJRYMJVFQQEGKOGL
VDFUGHJRVFLSMBMWMVROCQWMSTMRIA
NXGSRNVTFPDSCGAYTQOSRKTDINKEAW
VMOOMVCPYBGBYHEWHYFWITAENMRVJU
OLRJMZUCMEJYDEYHHYFZCRWDMBOKPA
OKQARABVXOAMZSUPYWPSZOAFRUFLMZ
KSICUXKPRDXFOXYWUTOIPLSLSQNIHJ
CRXCGPZXDKQFKJQSWYMDFPMCDWXFRB
FRCSTGWPEDHDJQKMJINMXLGKHQAEBL
UJUHSDGUFQBJBUULHMYDAPWLQXTQPX
HMYBKXGUIOEMYWKLMQJZXCIZOKCMSR

Picture detection Test A

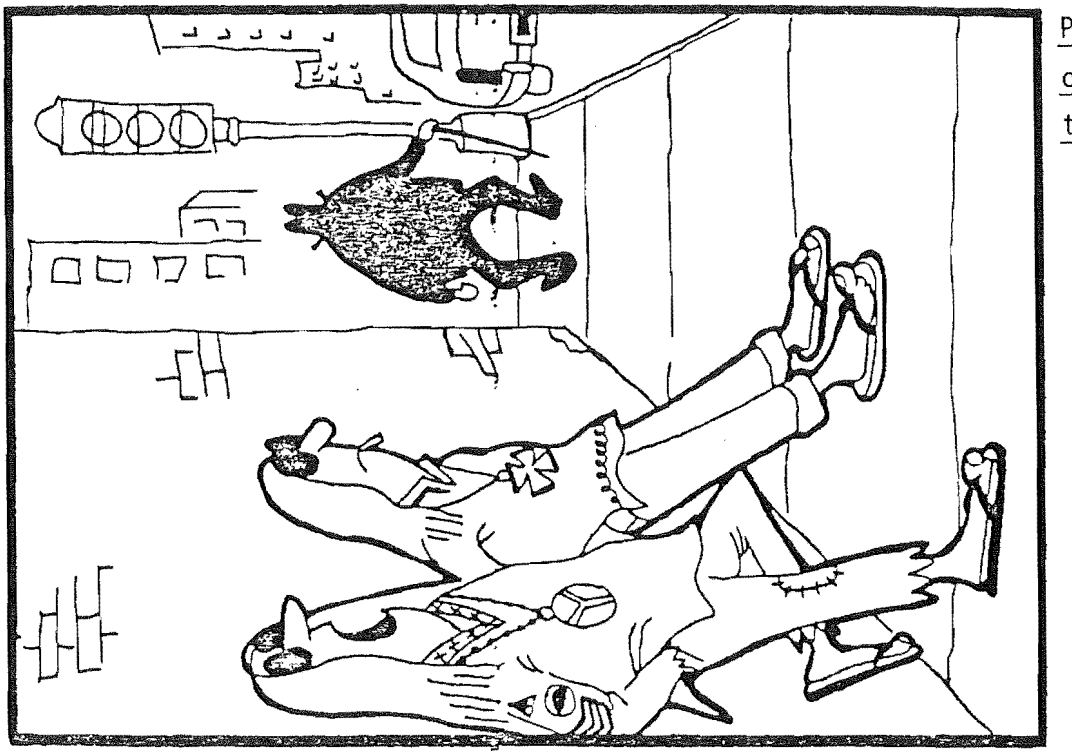


Score: _____

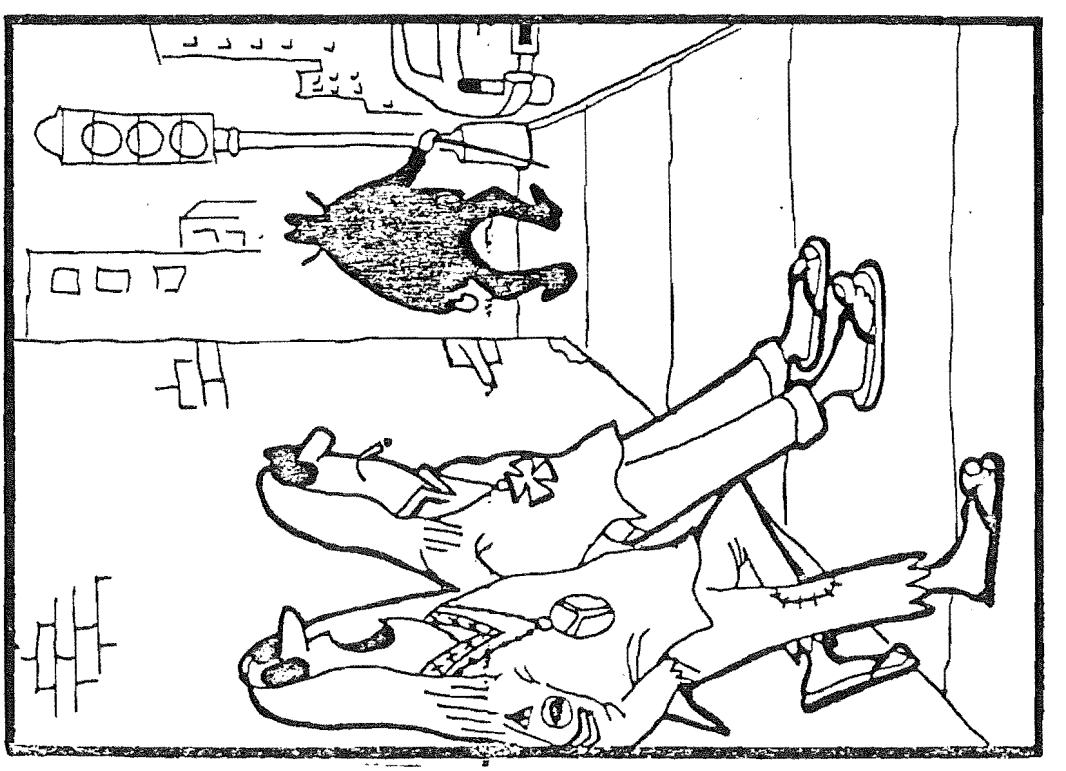
Name: _____



Picture detection test B



Score: _____



The STIMULUS GRID

Name: _____ Age: _____ Sex: M F

This rating form is a way of assessing how you perceive certain characteristics in other individuals. You are asked to rate a range of these descriptions against a number of people who are influential in your life.

Rate the individuals on a scale of 1 - 7, a 1 indicating that the description of the left-hand side is most appropriate and a 7 indicating that the description on the right-hand side is most appropriate. A 4 would mean that the person is neither one nor the other or that you don't know. If possible, try to avoid rating 4s.

Please work across each row before moving on to the next row. Work quickly as it is best to go by the first feeling you have in each case.

(Before you start it is easiest to decide on the persons you want to refer to and use the same person consistently throughout the whole column. Do not choose the same person twice except for the first four.)

Please turn over and have a look at the grid. Make sure you know what to do before you begin.

	1 2 3 4 5 6 7	THE PERSON: I am (1)	I would like to be (2)	I was 5 years ago (3)	I will be in 10 years' time (4)	I admire most (5)	I dislike most (6)	I like most (7)	who usually upsets me (8)	whom I find comforting (9)	whom I find threatening (10)	whose company I enjoy (11)
A	does not like to gamble - likes to gamble											
B	does not take risks - takes risks											
C	is usually calm - tends to worry											
D	does not like excitement - likes excitement											
E	is not concerned about failure - fears failure											
F	has high self-esteem - has low self-esteem											
G	does not need achievement - needs achievement											
H	is not aroused easily - is easily aroused											
I	does things better alone - does things better in a group											
J	has a liberal outlook - has a conservative outlook											
K	does not believe in luck - believes in luck											
L	prefers known outcomes - prefers uncertain outcomes											
M	is not superstitious - is superstitious											
N	is pessimistic - is optimistic											

APPENDIX 23

ANOVA summary table of the performance of gamblers and non-gamblers in the three externality tasks.

SOURCE	DEGREES OF FREEDOM	MEAN SQUARES	F	P =
ITEM RECALL				
Sex	1	0.02	0.01	0.942
Gam	1	15.35	3.69	0.063
Sex x Gam	1	15.06	3.62	0.065
EXPLAINED	3	10.14	2.43	0.081
RESIDUAL	36	4.17		
TOTAL	39	4.63		
LETTER IDENTIFICATION				
Sex	1	30.50	0.95	0.338
Gam	1	58.47	1.81	0.187
Sex x Gam	1	6.07	0.19	0.667
EXPLAINED	3	31.08	0.96	0.421
RESIDUAL	36	32.29		
TOTAL	39	32.20		
DIFFERENCE DETECTION				
Sex	1	1.25	0.22	0.643
Gam	1	14.54	2.55	0.119
Sex x Gam	1	1.55	0.27	0.606
EXPLAINED	3	5.72	1.00	0.403
RESIDUAL	36	5.71		
TOTAL	39	5.71		

APPENDIX 24

Gambling Assessment Questionnaire

Name: _____ Sex: _____ Age: _____

1. Do you sometimes gamble or take risks with money?

_____

How often do you do that? (circle one)

a. Two or more times a day
b. Every day or nearly every day
c. Three or four times a week
d. Once a week
e. Two or three times a month
f. About once a month
g. About six times a year
h. At least once a year
i. Less than once a year
j. Never

How much do you usually risk ?

(Quote a figure, e.g. about $5)

_____

2. Have you ever staked any money on the outcome of an event?

_____

How often have you done that? (circle one)

a. Two or more times a day
b. Every day or nearly every day
c. Three or four times a week
d. Once a week
e. Two or three times a month
f. About once a month
g. About six times a year
h. At least once a year
i. Less than once a year
j. Never

How much did you stake?

(Quote a figure, e.g. about $8)

_____

3. Do you enjoy gambling? Why?

_____

_____

_____

4. What is/are your preferred form(s) of gambling?

   (e.g. poker, horse-racing, etc.)

   _____

   _____

5. Do you usually gamble or stake money: (circle one)

   a. Hoping to win money?

   b. For the fun of it?

   c. Both?

   d. Other reasons (state) _____

6. In your opinion what is gambling?

   _____

   _____

   _____

7. How do you feel about gambling?

   _____

   _____

   _____

8. How do you feel about people who gamble?

   _____

   _____

   _____

9. Is playing space-invaders a form of gambling? Why? Why not?

_____

_____

_____

_____

10. Is gambling an addiction?

_____

_____

11. Do you possess any item that you think brings you luck?

_____

12. Do you think there is any difference between luck and fate? If so, what?

_____

_____

_____

_____

13. Are you superstitious? (circle one)

not at all very much

1 2 3 4 5 6 7

14. Do you believe in luck? (circle one)

not at all very much

1 2 3 4 5 6 7

APPENDIX 25

The AROUSAL GRID

NAME: _____

This form is a way of recording how you feel about certain situations. You are asked to rate a number of emotions against a range of situations. These situations are ones that you may encounter in your daily routine.

When rating use these numbers as follows:

NEVER HALF THE TIME ALWAYS

1 2 3 4 5 6 7

Please work across each row before moving on to the next row. Work quickly as it is best to go by the first feeling you have in each case.

	1. decision making	2. uncertainty	3. challenge	4. monetary gain	5. loss of control	6. testing predictions	7. superstitious behaviour	8. losing money in a bet	9. risk taking	10. having a bet	11. beating the system
1. anxiety											
2. thrill											
3. anger											
4. frustration											
5. interest											
6. joy											
7. excitement											
8. determination											
9. depression											
10. elation											
11. remorse											
12. optimism											

APPENDIX 26
PRE-EXPERIMENTAL QUESTIONNAIRE

1. If you are given the choice of game to gamble against us, would you select one which is *(circle one)*

   (a) totally determined by chance alone

   (b) largely determined by chance

   (c) equally determined by chance and skill

   (d) largely determined by skill

   (e) totally determined by skill alone

2. Do you think there is any skill involved in correctly predicting the outcome of a tossed coin? *(circle one)*

   not at all — a lot

   1 2 3 4 5 6 7

3. If you have to, would you rather *(circle one)*

   (a) roll a marble into one of five different sized holes with the biggest hole paying the least and the smallest hole paying the most, or

   (b) draw one out of five coloured marbles from a bag to decide the same reward?

4. Would you prefer the chance of winning *(circle one)*

   (a) $3.00 with a probability of .1

   (b) $1.20 with a probability of .25

   (c) $0.60 with a probability of .5

   (d) $0.40 with a probability of .75

   (e) $0.30 with a probability of 1

5. Do you think you are likely to win in the game you are going to play? *(circle one)*

   very unlikely — very likely

   1 2 3 4 5 6 7

POST-EXPERIMENTAL QUESTIONNAIRE

1. Did you enjoy the game? *(circle one)*

not at all very much

1 2 3 4 5 6 7

2. Do you think the game involves mainly chance or skill on your part? *(circle one)*

chance skill

1 2 3 4 5 6 7

3. Do you think that you were lucky or unlucky during the game? *(circle one)*

unlucky lucky

1 2 3 4 5 6 7

4. What do you think is the most important factor contributing to your overall win or loss? *(circle one)*

(a) chance

(b) luck

(c) skill in playing

(d) knowledge of odds

(e) other (please specify) _____

5. Do you think the game was fair (not rigged)? *(circle one)*

(a) yes

(b) could be

(c) no

(d) probably not

(e) don't know

6. Were there any cues which may have influenced the way you bet? (Please elaborate)

_____

_____

_____

_____

APPENDIX 28

The payoff schedule of the 30 gambling trials.

Trial	Payoff	
1	1	
2	0	
3	1	
4	1	
5	0	T5 = after-2-win trial
6	1	
7	0	T7 = after-1-win trial
8	2	
9	0	T9 = after-a-double-win trial
10	0	
11	0	
12	1	T12 = a double-win followed by 3 losses
13	1	
14	1	
15	0	T15 = after-3-wins
16	0	
17	1	
18	0	
19	0	
20	0	
21	1	T21 = 1-win followed by 3 losses
22	0	
23	1	T23 = after-1-loss
24	0	
25	0	
26	1	T26 = after-2-losses
27	1	
28	0	
29	1	
30	0	
31	1	
32	0	
33	1	Trials 31 - 35 are optional gambles
34	0	(not included in the analysis)
35	1	

0 denotes a loss,

1 denotes a win,

2 denotes winning twice the amount staked and,

Tx denotes trials singled out for in-depth analyses (on an a priori basis).

APPENDIX 29

Instructions of how the game was to be played that were presented to the subjects on the computer monitor.

Welcome to the experiment. In a moment you will be playing a simple game against us, that is, the computer and the experimenter. When you are using this computer, press the RETURN key if you want to proceed with the instructions and also after you have made an entry.

Now, what do you do if you want to go on?

RETURN

That's right!

If you want to erase something you have typed, press the key with the arrow pointing towards your left as many times as required, then type in your new response.

RETURN

If you encounter any difficulty at any time, call the experimenter. Please don't feel embarrassed about asking since it is probably due to the ambiguity of the instructions rather than a lack of understanding on your part.

RETURN

I shall now proceed to explain the rules of the game. A box containing six numbers, corresponding to the sides of a die, will appear on the screen. Your task is to predict which number(s) will come up. You are only allowed to choose one number each time. First, you indicate the chance of you winning in the gamble. Then you type in the amount of money you want to bet that the number you have chosen will turn up.

Finally, you type in the chance that you think that you will make the correct prediction.

RETURN

Next, the result of your decision will appear on the screen.

RETURN

If the number that you choose turns up once you will be paid the amount you staked. If your number turns up on two dice then you will be paid twice the amount you staked, and if all three dice turn up the number you staked then you get paid three times the amount.

Your current total sum of money you have in your possession will be displayed after each trial.

RETURN

You will be given a sum of $3.00 to play against us. You get to keep an unknown percentage of the balance after the gambling session is over so it would be to your advantage to try to win as much as you can.

RETURN

However, if you lose more than the initial amount given to you, you will be obliged to pay us the money in terms of time to participate in another experiment.

After a certain number of trials you will be asked whether you want to stop. Your response will influence the length of the session.

RETURN

During the session you will be required to answer a few questions and your heart-rate will be monitored at specific intervals using a very simple and conveneint gadget.

Before you start the game proper you are given two practice

trials to familiarise you to the situation.

RETURN

Practice trials.

Are you ready to commence the actual gambling session?

(Press `Y' for yes and `N' for no. From now on, just press `Y' or `N' when you have to answer yes or no respectively.

RETURN

Do you want (A): To go through the instructions again? or,

(B): Have one more practice trial?

Type in your choice, A or B.

RESPONSE

Good, we shall now begin. Good luck!

(No response required)

The sequence of events that takes place during a single trial is listed earlier in the method section.

After the last trial is played (either 30 or 35 trials in all) the final statement comes on the screen.

Thank you for taking part in the experiment. I hope you have enjoyed yourself. Please fill in the short questionnaire sheet contained in the folder on your right.

ANOVA output table of the mean bets of all the 30 trials taken together.

SOURCE OF VARIATION			SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS			953.963	5	190.793	1.227	0.305
GAM			750.408	1	750.408	4.826	0.031
WILD			86.515	1	86.515	0.556	0.458
GCUE			0.758	1	0.758	0.005	0.945
AROUSAL			116.282	2	58.141	0.374	0.689
2-WAY INTERACTIONS			969.165	9	107.718	0.693	0.713
GAM	WILD		91.131	1	91.131	0.586	0.446
GAM	GCUE		704.886	1	704.886	4.533	0.037
GAM	AROUSAL		21.019	2	10.510	0.068	0.935
WILD	GCUE		52.905	1	52.905	0.340	0.561
WILD	AROUSAL		48.040	2	24.020	0.154	0.857
GCUE	AROUSAL		51.485	2	25.742	0.166	0.848
3-WAY INTERACTIONS			366.286	7	52.326	0.336	0.935
GAM	WILD	GCUE	255.017	1	255.017	1.640	0.204
GAM	WILD	AROUSAL	74.424	2	37.212	0.239	0.788
GAM	GCUE	AROUSAL	4.926	2	2.463	0.016	0.984
WILD	GCUE	AROUSAL	31.918	2	15.959	0.103	0.903
EXPLAINED			2289.715	21	109.034	0.701	0.819
RESIDUAL			11507.281	74	155.504		
TOTAL			13796.996	95	145.232		

96 CASES WERE PROCESSED.
0 CASES (0.0 PCT) WERE MISSING.

MANOVA output table of the mean bets following a winning outcome.

TESTS OF SIGNIFICANCE FOR WB USING SEQUENTIAL SUMS OF SQUARES

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIG. OF F
WITHIN CELLS	22810.73595	72	316.81578		
CONSTANT	124276.70929	1	124276.70929	392.26806	0.0
GAM	1457.89876	1	1457.89876	4.60172	.035
WILO	173.47001	1	173.47001	.54754	.462
GCUE	1.01044	1	1.01044	.00319	.955
AROUSAL	278.82583	2	139.41292	.44004	.646
GAM BY WILO	192.71501	1	192.71501	.60829	.438
GAM BY GCUE	1512.72924	1	1512.72924	4.77479	.032
GAM BY AROUSAL	41.06868	2	20.53434	.06481	.937
WILO BY GCUE	108.96635	1	108.96635	.34394	.559
WILO BY AROUSAL	80.71461	2	40.35730	.12738	.881
GCUE BY AROUSAL	108.42580	2	54.21290	.17112	.843
GAM BY WILO BY GCUE	523.61596	1	523.61596	1.65275	.203
GAM BY WILO BY AROUSAL	139.65085	2	69.82542	.22040	.803
GAM BY GCUE BY AROUSAL	11.07700	2	5.53850	.01748	.983
WILO BY GCUE BY AROUSAL	65.68443	2	32.84222	.10366	.902
GAM BY WILO BY GCUE BY AROUSAL	499.09147	2	249.54574	.78767	.459

1. MANOVA output table of bets in the after-double-win and after-double-3-losses gambles.
2. MANOVA output table of the mean bets following a losing outcome.

1. SOURCE OF VARIATION

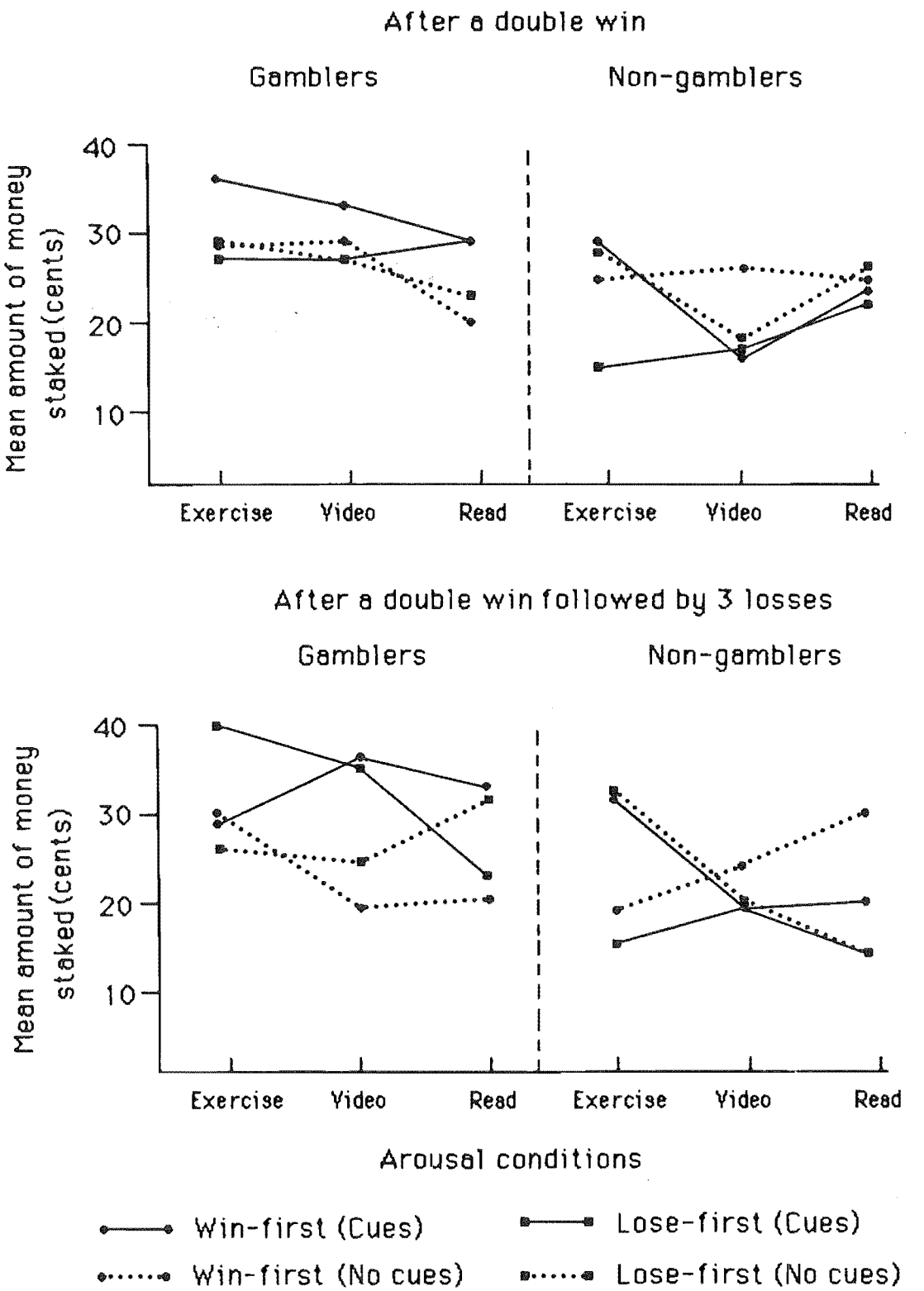
SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIG. OF F
WITHIN CELLS	30423.50000	72	422.54861		
CONSTANT	122816.33333	1	122816.33333	290.65610	0.0
GAM	2028.00000	1	2028.00000	4.79945	.032
WILO	157.68750	1	157.68750	.37318	.543
GCUE	48.00000	1	48.00000	.11360	.737
AROUSAL	437.88542	2	218.94271	.51815	.598
GAM BY WILO	221.02083	1	221.02083	.52307	.472
GAM BY GCUE	1121.33333	1	1121.33333	2.65374	.108
GAM BY AROUSAL	197.53125	2	98.76562	.23374	.792
WILO BY GCUE	247.52083	1	247.52083	.58578	.447
WILO BY AROUSAL	1.15625	2	.57813	.00137	.999
GCUE BY AROUSAL	23.15625	2	11.57813	.02740	.973
GAM BY WILO BY GCUE	1.02083	1	1.02083	.00242	.961
GAM BY WILO BY AROUSAL	47.13542	2	23.56771	.05578	.946
GAM BY GCUE BY AROUSAL	31.01042	2	15.50521	.03669	.964
WILO BY GCUE BY AROUSAL	254.88542	2	127.44271	.30160	.741
GAM BY WILO BY GCUE BY AROUSAL	1095.82292	2	547.91146	1.29668	.280

2. TESTS OF SIGNIFICANCE FOR LB USING SEQUENTIAL SUMS OF SQUARES

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIG. OF F
WITHIN CELLS	694.38699	72	9.64426		
OUTCOME	.22983	1	.22983	.02383	.878
GAM AND OUTCOME	1.59504	1	1.59504	.16539	.685
WILO AND OUTCOME	.54340	1	.54340	.05634	.813
GCUE AND OUTCOME	6.30232	1	6.30232	.65348	.422
AROUSAL AND OUTCOME	4.04799	2	2.02399	.20987	.811
GAM BY WILO AND OUTCOME	10.71496	1	10.71496	1.11102	.295
GAM BY GCUE AND OUTCOME	2.21941	1	2.21941	.23013	.633
GAM BY AROUSAL AND OUTCOME	6.39131	2	3.19565	.33135	.719
WILO BY GCUE AND OUTCOME	5.74577	1	5.74577	.59577	.443
WILO BY AROUSAL AND OUTCOME	2.06957	2	1.03478	.10730	.898
GCUE BY AROUSAL AND OUTCOME	14.65662	2	7.32831	.75986	.471
GAM BY WILO BY GCUE AND OUTCOME	21.95689	1	21.95689	2.27668	.136
GAM BY WILO BY AROUSAL AND OUTCOME	6.95031	2	3.47515	.36033	.699
GAM BY GCUE BY AROUSAL AND OUTCOME	16.04183	2	8.02091	.83168	.439
WILO BY GCUE BY AROUSAL AND OUTCOME	67.20199	2	33.60100	3.48404	.036
GAM BY WILO BY GCUE BY AROUSAL AND OUTCOME	22.71347	2	11.35673	1.17756	.314

APPENDIX 33

The effect of arousal, having a good or bad reinforcement schedule first and gambling cues on the betting behaviour of gamblers and non-gamblers after experiencing a double win and after experiencing a double win followed by 3 losses.



MANOVA output table of bets following winning versus losing outcomes.

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIG. OF F
WITHIN CELLS	70530.79167	72	979.59433		
CONSTANT	382593.79340	1	382593.79340	390.56350	0.0
GAM	4026.96007	1	4026.96007	4.11084	.046
WILD	648.12674	1	648.12674	.66163	.419
GCUE	42.79340	1	42.79340	.04368	.835
AROUSAL	610.84722	2	305.42361	.31179	.733
GAM BY WILD	958.41840	1	958.41840	.97838	.326
GAM BY GCUE	5383.89062	1	5383.89062	5.49604	.022
GAM BY AROUSAL	294.68056	2	147.34028	.15041	.861
WILD BY GCUE	350.00174	1	350.00174	.35729	.552
WILD BY AROUSAL	361.05556	2	180.52778	.18429	.832
GCUE BY AROUSAL	490.68056	2	245.34028	.25045	.779
GAM BY WILD BY GCUE	2437.89063	1	2437.89063	2.48867	.119
GAM BY WILD BY AROUSAL	983.68056	2	491.84028	.50209	.607
GAM BY GCUE BY AROUSAL	29.29167	2	14.64583	.01495	.985
WILD BY GCUE BY AROUSAL	718.76389	2	359.38194	.36687	.694
GAM BY WILD BY GCUE BY AROUSAL	1608.50000	2	804.25000	.82100	.444

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIG. OF F
WITHIN CELLS	10795.29167	72	149.93461		
OUTCOME	13.75174	1	13.75174	.09172	.763
GAM AND OUTCOME	14.37674	1	14.37674	.09589	.758
WILD AND OUTCOME	43.89062	1	43.89062	.29273	.590
GCUE AND OUTCOME	388.41840	1	388.41840	2.59059	.112
AROUSAL AND OUTCOME	104.22222	2	52.11111	.34756	.708
GAM BY WILD AND OUTCOME	121.91840	1	121.91840	.81314	.370
GAM BY GCUE AND OUTCOME	137.08507	1	137.08507	.91430	.342
GAM BY AROUSAL AND OUTCOME	1.34722	2	.67361	.00449	.996
WILD BY GCUE AND OUTCOME	72.96007	1	72.96007	.48661	.488
WILD BY AROUSAL AND OUTCOME	27.37500	2	13.68750	.09129	.913
GCUE BY AROUSAL AND OUTCOME	31.59722	2	15.79861	.10537	.900
GAM BY WILD BY GCUE AND OUTCOME	800.41840	1	800.41840	5.33845	.024
GAM BY WILD BY AROUSAL AND OUTCOME	37.09722	2	18.54861	.12371	.884
GAM BY GCUE BY AROUSAL AND OUTCOME	187.05556	2	93.52778	.62379	.539
WILD BY GCUE BY AROUSAL AND OUTCOME	280.68056	2	140.34028	.93601	.397
GAM BY WILD BY GCUE BY AROUSAL AND OUTCO ME	317.34722	2	158.67361	1.05829	.352

MANOVA output table of bets following runs of wining versus losing outcomes.

TESTS OF SIGNIFICANCE FOR WITHIN CELLS USING SEQUENTIAL SUMS OF SQUARES

SOURCE OF VARIATION	WILKS LAMBDA	APPROX MULT F	SIG. OF F	AVERAGED F	SIG. OF F
RUNS	.99529	.23986	.787	.23987	.795
GAM AND RUNS	.99520	.17112	.843	.17113	.843
WILO AND RUNS	.90597	3.68454	.030	4.27628	.016
GCUE AND RUNS	.96949	1.11727	.333	1.17157	.313
AROUSAL AND RUNS	.97080	.43743	.781	.41937	.794
GAM BY WILO AND RUNS	.99661	.12061	.887	.11141	.895
GAM BY GCUE AND RUNS	.99119	.31551	.730	.36511	.696
GAM BY AROUSAL AND RUNS	.91623	1.58732	.191	1.49770	.206
WILO BY GCUE AND RUNS	.97582	.97950	.419	.76949	.465
WILO BY AROUSAL AND RUNS	.96587	.62184	.648	.57108	.684
GCUE BY AROUSAL AND RUNS	.91998	1.53389	.196	1.75452	.141
GAM BY WILO BY GCUE AND RUNS	.95063	1.84367	.166	1.97052	.143
GAM BY WILO BY AROUSAL AND RUNS	.96806	.58087	.677	.53711	.709
GAM BY GCUE BY AROUSAL AND RUNS	.89530	2.01837	.095	2.35325	.057
WILO BY GCUE BY AROUSAL AND RUNS	.96281	.67908	.608	.63222	.640
GAM BY WILO BY GCUE BY AROUSAL AND RUNS	.93139	1.28422	.279	1.20551	.311

TESTS OF SIGNIFICANCE FOR WITHIN CELLS USING SEQUENTIAL SUMS OF SQUARES

SOURCE OF VARIATION	WILKS LAMBDA	APPROX MULT F	SIG. OF F	AVERAGED F	SIG. OF F
OUTCOME BY RUNS	.96883	1.14216	.325	.91578	.403
GAM AND OUTCOME BY RUNS	.98968	.37005	.692	.29343	.745
WILO AND OUTCOME BY RUNS	.97627	.86276	.426	.74419	.477
GCUE AND OUTCOME BY RUNS	.99570	.15317	.858	.18809	.829
AROUSAL AND OUTCOME BY RUNS	.96567	.62560	.645	.71244	.585
GAM BY WILO AND OUTCOME BY RUNS	.98026	.71475	.493	.87825	.418
GAM BY GCUE AND OUTCOME BY RUNS	.99528	.16832	.845	.20540	.815
GAM BY AROUSAL AND OUTCOME BY RUNS	.97237	.50089	.735	.42721	.789
WILO BY GCUE AND OUTCOME BY RUNS	.96458	1.30367	.278	1.38762	.253
WILO BY AROUSAL AND OUTCOME BY RUNS	.92500	1.41121	.233	1.25254	.292
GCUE BY AROUSAL AND OUTCOME BY RUNS	.98517	.26628	.899	.32867	.858
GAM BY WILO BY GCUE AND OUTCOME BY RUNS	.95678	1.60348	.208	1.92214	.150
GAM BY WILO BY AROUSAL AND OUTCOME BY RUNS	.91359	1.64097	.167	1.49685	.206
GAM BY GCUE BY AROUSAL AND OUTCOME BY RUNS	.98278	.30963	.871	.36998	.830
WILO BY GCUE BY AROUSAL AND OUTCOME BY RUNS	.90191	1.88066	.117	1.96149	.104
GAM BY WILO BY GCUE BY AROUSAL AND OUTCOME BY RUNS	.92841	1.34337	.257	1.19526	.315

APPENDIX 36

ANOVA output tables of estimates of the chances of winning and making correct predictions.

1. Estimates of chances of winning.

SOURCE OF VARIATION			SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS			3543.809	5	708.762	2.314	0.052
GAM			1446.938	1	1446.938	4.725	0.033
WILD			195.989	1	195.989	0.640	0.426
GCUE			2.999	1	2.999	0.010	0.921
AROUSAL			1897.883	2	948.941	3.099	0.051
2-WAY INTERACTIONS			331.980	9	36.887	0.120	0.999
GAM	WILD		123.988	1	123.988	0.405	0.527
GAM	GCUE		12.255	1	12.255	0.040	0.842
GAM	AROUSAL		28.671	2	14.335	0.047	0.954
WILD	GCUE		43.786	1	43.786	0.143	0.706
WILD	AROUSAL		81.301	2	40.650	0.133	0.876
GCUE	AROUSAL		41.986	2	20.993	0.069	0.934
3-WAY INTERACTIONS			515.206	7	73.601	0.240	0.974
GAM	WILD	GCUE	12.833	1	12.833	0.042	0.838
GAM	WILD	AROUSAL	133.635	2	66.817	0.218	0.804
GAM	GCUE	AROUSAL	321.316	2	160.658	0.525	0.594
WILD	GCUE	AROUSAL	47.422	2	23.711	0.077	0.926
EXPLAINED			4391.000	21	209.095	0.683	0.836
RESIDUAL			22661.926	74	306.242		
TOTAL			27052.926	95	284.768		

2. Estimates of making correct prediction.

SOURCE OF VARIATION			SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS			2889.500	5	577.900	1.865	0.111
GAM			1252.584	1	1252.584	4.043	0.048
WILD			130.903	1	130.903	0.422	0.518
GCUE			138.484	1	138.484	0.447	0.506
AROUSAL			1367.528	2	683.764	2.207	0.117
2-WAY INTERACTIONS			1436.709	9	159.634	0.515	0.859
GAM	WILD		69.758	1	69.758	0.225	0.637
GAM	GCUE		248.003	1	248.003	0.800	0.374
GAM	AROUSAL		156.447	2	78.224	0.252	0.778
WILD	GCUE		281.424	1	281.424	0.908	0.344
WILD	AROUSAL		443.031	2	221.515	0.715	0.493
GCUE	AROUSAL		238.048	2	119.024	0.384	0.682
3-WAY INTERACTIONS			999.427	7	142.775	0.461	0.860
GAM	WILD	GCUE	167.568	1	167.568	0.541	0.464
GAM	WILD	AROUSAL	151.745	2	75.873	0.245	0.783
GAM	GCUE	AROUSAL	426.556	2	213.278	0.688	0.506
WILD	GCUE	AROUSAL	253.558	2	126.779	0.409	0.666
EXPLAINED			5325.637	21	253.602	0.818	0.689
RESIDUAL			22929.027	74	309.852		
TOTAL			28254.664	95	297.417		

96 CASES WERE PROCESSED.
0 CASES (0.0 PCT) WERE MISSING.

* C R O S S T A B U L A T I O N O F *
GAM GAMBLER OR NON-GAMBLER BY PAY SELECTION OF TYPES OF PAYMENT
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INVOLVE CHANCE-SKILL INVOLVEMENT CHANCE1 TO SKIL
BY GAM GAMBLER OR NON-GAMBLER
WILO WINFIRST OR LOSEFIRST
GCUE GAMBLING CUES OR NO GAMBLING CUES
AROUSAL EXER VIDEO READ

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SOURCE OF VARIATION			SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS			23.844	5	4.769	3.094	0.014
GAM			10.010	1	10.010	6.494	0.013
WILO			3.010	1	3.010	1.953	0.166
GCUE			0.260	1	0.260	0.169	0.682
AROUSAL			10.562	2	5.281	3.426	0.038
2-WAY INTERACTIONS			18.885	9	2.098	1.361	0.221
GAM	WILO		4.594	1	4.594	2.980	0.088
GAM	GCUE		1.260	1	1.260	0.818	0.369
GAM	AROUSAL		6.521	2	3.260	2.115	0.128
WILO	GCUE		0.844	1	0.844	0.547	0.462
WILO	AROUSAL		4.771	2	2.385	1.548	0.220
GCUE	AROUSAL		0.896	2	0.448	0.291	0.749
3-WAY INTERACTIONS			10.365	7	1.481	0.961	0.466
GAM	WILO	GCUE	0.094	1	0.094	0.061	0.806
GAM	WILO	AROUSAL	4.563	2	2.281	1.480	0.234
GAM	GCUE	AROUSAL	3.771	2	1.885	1.223	0.300
WILO	GCUE	AROUSAL	1.937	2	0.969	0.628	0.536
EXPLAINED			53.094	21	2.528	1.640	0.063
RESIDUAL			114.062	74	1.541		
TOTAL			167.156	95	1.760		

96 CASES WERE PROCESSED.
0 CASES (0.0 PCT) WERE MISSING.

* * * * * * * * * * A N A L Y S I S O F V A R I A N C E * * * * * * * * * *
PREDICT SKILL IN PREDICTION NONE1 TO A LOT7
BY GAM GAMBLER OR NON-GAMBLER
* *

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	1.760	1	1.760	0.908	0.343
GAM	1.760	1	1.760	0.908	0.343
EXPLAINED	1.760	1	1.760	0.908	0.343
RESIDUAL	182.229	94	1.939		
TOTAL	183.989	95	1.937		

96 CASES WERE PROCESSED.
0 CASES (0.0 PCT) WERE MISSING.

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PREFER PREFERENCE OF PROB LOW1 TO HIGH5
BY GAM GAMBLER OR NON-GAMBLER

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SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	8.760	1	8.760	5.274	0.024
GAM	8.760	1	8.760	5.274	0.024
EXPLAINED	8.760	1	8.760	5.274	0.024
RESIDUAL	156.145	94	1.661		
TOTAL	164.906	95	1.736		

96 CASES WERE PROCESSED.
0 CASES (0.0 PCT) WERE MISSING.

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BELIEF BELIEF IN LUCK NOT AT ALL1 TO VERY MUCH
BY GAM GAMBLER OR NON-GAMBLER

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SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	29.260	1	29.260	11.631	0.001
GAM	29.260	1	29.260	11.631	0.001
EXPLAINED	29.260	1	29.260	11.631	0.001
RESIDUAL	236.478	94	2.516		
TOTAL	265.738	95	2.797		

96 CASES WERE PROCESSED.
0 CASES (0.0 PCT) WERE MISSING.

* * * * * * * * * * A N A L Y S I S O F V A R I A N C E * * * * * * * * * *

LUCK LUCKY-UNLUCKY IN GAME UNLUCKY1 TO LUCKY
BY GAM GAMBLER OR NON-GAMBLER
WILO WINFIRST OR LOSEFIRST
GCUE GAMBLING CUES OR NO GAMBLING CUES
AROUSAL EXER VIDEO READ

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LIKELY LIKELIHOOD OF WINNING NOT LIKELY1 TO VER
BY GAM GAMBLER OR NON-GAMBLER

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SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS	18.375	1	18.375	11.916	0.001
GAM	18.375	1	18.375	11.916	0.001
EXPLAINED	18.375	1	18.375	11.916	0.001
RESIDUAL	144.958	94	1.542		
TOTAL	163.333	95	1.719		

96 CASES WERE PROCESSED.
0 CASES (0.0 PCT) WERE MISSING.

* * * * * * * * * * A N A L Y S I S O F V A R I A N C E * * * * * * * * * *

ENJOY ENJOYMENT OF GAME NONE1 TO A LOT7

BY GAM GAMBLER OR NON-GAMBLER

WILO WINFIRST OR LOSEFIRST

GCUE GAMBLING CUES OR NO GAMBLING CUES

AROUSAL EXER VIDEO READ

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SOURCE OF VARIATION			SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS			35.604	5	7.121	3.249	0.010
GAM			20.167	1	20.167	9.201	0.003
WILO			3.375	1	3.375	1.540	0.219
GCUE			1.500	1	1.500	0.684	0.411
AROUSAL			10.563	2	5.281	2.410	0.097
2-WAY INTERACTIONS			25.396	9	2.822	1.287	0.258
GAM	WILO		2.042	1	2.042	0.932	0.338
GAM	GCUE		0.167	1	0.167	0.076	0.784
GAM	AROUSAL		10.396	2	5.198	2.372	0.100
WILO	GCUE		1.042	1	1.042	0.475	0.493
WILO	AROUSAL		4.938	2	2.469	1.126	0.330
GCUE	AROUSAL		6.813	2	3.406	1.554	0.218
3-WAY INTERACTIONS			21.312	7	3.045	1.389	0.223
GAM	WILO	GCUE	0.375	1	0.375	0.171	0.680
GAM	WILO	AROUSAL	15.771	2	7.885	3.598	0.032
GAM	GCUE	AROUSAL	4.396	2	2.198	1.003	0.372
WILO	GCUE	AROUSAL	0.771	2	0.385	0.176	0.839
EXPLAINED			82.313	21	3.920	1.788	0.036
RESIDUAL			162.186	74	2.192		
TOTAL			244.499	95	2.574		

96 CASES WERE PROCESSED.
0 CASES (0.0 PCT) WERE MISSING.

* * * * * * * * * * A N A L Y S I S O F V A R I A N C E * * * * * * * * * *

TRIALS NUMBER OF TRIALS WANTED
BY GAM GAMBLER OR NON-GAMBLER
WILO WINFIRST OR LOSEFIRST
GCUE GAMBLING CUES OR NO GAMBLING CUES
AROUSAL EXER VIDEO READ

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SOURCE OF VARIATION			SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS			2492.313	5	498.462	7.227	0.000
GAM			2053.500	1	2053.500	29.772	0.000
WILO			40.042	1	40.042	0.581	0.449
GCUE			360.375	1	360.375	5.225	0.025
AROUSAL			38.396	2	19.198	0.278	0.758
2-WAY INTERACTIONS			619.729	9	68.859	0.998	0.449
GAM	WILO		204.167	1	204.167	2.960	0.090
GAM	GCUE		1.500	1	1.500	0.022	0.883
GAM	AROUSAL		42.438	2	21.219	0.308	0.736
WILO	GCUE		1.042	1	1.042	0.015	0.903
WILO	AROUSAL		17.271	2	8.635	0.125	0.883
GCUE	AROUSAL		353.313	2	176.656	2.561	0.084
3-WAY INTERACTIONS			691.771	7	98.824	1.433	0.205
GAM	WILO	GCUE	16.667	1	16.667	0.242	0.624
GAM	WILO	AROUSAL	97.896	2	48.948	0.710	0.495
GAM	GCUE	AROUSAL	492.437	2	246.219	3.570	0.033
WILO	GCUE	AROUSAL	84.771	2	42.385	0.615	0.544
EXPLAINED			3803.813	21	181.134	2.626	0.001
RESIDUAL			5104.109	74	68.974		
TOTAL			8907.922	95	93.768		

96 CASES WERE PROCESSED.
0 CASES (0.0 PCT) WERE MISSING.

* * * * * * * * * * A N A L Y S I S O F V A R I A N C E * * * * * * * * * *

TOTAL TOTAL SUM ENDED UP WITH IN THE END
BY GAM GAMBLER OR NON-GAMBLER
WILO WINFIRST OR LOSEFIRST
GCUE GAMBLING CUES OR NO GAMBLING CUES
AROUSAL EXER VIDEO READ

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SOURCE OF VARIATION			SUM OF SQUARES	DF	MEAN SQUARE	F	SIGNIF OF F
MAIN EFFECTS			27103.301	5	5420.660	1.528	0.192
GAM			508.760	1	508.760	0.143	0.706
WILO			6353.760	1	6353.760	1.791	0.185
GCUE			2233.010	1	2233.010	0.629	0.430
AROUSAL			18007.770	2	9003.885	2.537	0.086
2-WAY INTERACTIONS			82195.047	9	9132.781	2.574	0.012
GAM	WILO		585.094	1	585.094	0.165	0.686
GAM	GCUE		1953.010	1	1953.010	0.550	0.461
GAM	AROUSAL		38240.766	2	19120.383	5.388	0.007
WILO	GCUE		931.260	1	931.260	0.262	0.610
WILO	AROUSAL		31792.020	2	15896.010	4.480	0.015
GCUE	AROUSAL		8692.895	2	4346.447	1.225	0.300
3-WAY INTERACTIONS			20210.070	7	2887.153	0.814	0.579
GAM	WILO	GCUE	348.844	1	348.844	0.098	0.755
GAM	WILO	AROUSAL	19287.438	2	9643.719	2.718	0.073
GAM	GCUE	AROUSAL	193.146	2	96.573	0.027	0.973
WILO	GCUE	AROUSAL	380.646	2	190.323	0.054	0.948
EXPLAINED			129508.438	21	6167.068	1.738	0.043
RESIDUAL			262582.563	74	3548.413		
TOTAL			392091.000	95	4127.273		

96 CASES WERE PROCESSED.
0 CASES (0.0 PCT) WERE MISSING.

APPENDIX 47

The polar co-ordinates of the constructs and projections for elements for the gambler STIMULUS GRID.

Polar co-ordinates

Constructs	H	V	R
1	-124.4	-10.4	0.88
2	-155.0	2.7	0.92
3	-15.4	9.3	0.99
4	-166.7	4.8	0.99
5	-20.0	-13.4	0.75
6	-24.2	13.3	0.98
7	-147.7	-13.3	0.66
8	-65.4	11.2	0.70
9	47.2	55.7	0.92
10	-8.4	0.1	0.99
11	-141.3	-1.1	0.79
12	-160.6	55.8	0.86
13	-0.1	-15.5	0.93
14	167.7	3.5	0.99

Projections for elements

Elements	H	V	R
1	-113.7	6.0	0.93
2	167.4	-10.1	0.94
3	-21.1	-55.0	0.76
4	-163.8	-17.7	0.89
5	176.5	-26.0	0.82
6	-4.9	-5.3	0.98
7	171.1	-0.3	0.78
8	19.2	-0.7	0.93
9	93.0	9.5	0.95
10	-41.4	40.8	0.84
11	159.2	52.2	0.97

The values of H and V (horizontal and vertical measurements in degrees) are the ones used for plotting the positions of the constructs. The convention for plotting is as follows: A point on the equator is selected as the origin, with H = 0 degrees and V = 0 degrees. Positive values of H are reached by moving eastwards around the globe for the given number of degrees, and the negative values by moving westwards. Positive values of V are reached by moving northwards and negative ones southwards.

The radial measurement, R, is not used in the mapping. A construct can only be located on the surface of the sphere if its value of R is 1.00, otherwise it should be located beneath the surface. R also defines the multiple coorelation between the construct and the first 3 components; and R squared is the proportion of its total variation they account for.

APPENDIX 48

The loadings of the first 3 components of the elements and constructs derived from the INGRID analysis of the gambler STIMULUS GRID.

	ELEMENT The person	COMP. 1 LOADING	COMP. 2 LOADING	COMP. 3 LOADING
1	I am	-0.75	-1.72	0.20
2	I would like to be	-2.38	0.53	-0.43
3	I was 5 years ago	0.42	-0.16	-0.64
4	I will be in 10 years time	-1.67	-0.49	-0.56
5	I admire most	-1.66	0.10	-0.81
6	I dislike most	4.68	-0.39	-0.44
7	I like most	-1.10	0.17	-0.01
8	who usually upsets me	2.75	0.96	-0.04
9	whom I find comforting	-0.07	1.35	0.22
10	whom I find threatening	0.87	-0.77	1.00
11	whose company I enjoy	-1.08	0.41	1.49
	CONSTRUCTS			
1	does not like/ likes to gamble	-0.92	-1.34	-0.30
2	does not take/ takes risks	-2.15	-1.00	0.11
3	is usually calm/ tends to worry	2.89	-0.80	0.49
4	does not like/ likes excitement	-2.54	-0.60	0.22
5	is not concerned/ fears failure	1.15	-0.42	-0.29
6	has high/ has low self-esteem	1.81	-0.81	0.47
7	does not need/ needs achievement	-0.85	-0.54	-0.23
8	is not/ is easily aroused	0.32	-0.71	0.15
9	does better alone/ in a group	0.62	0.66	1.33
10	has liberal/ conservative outlook	2.81	-0.41	0.01
11	does not/ believes in luck	-1.06	-0.85	-0.03
12	prefers known/ uncertain outcomes	-0.97	-0.34	1.52
13	is not/ is superstitious	1.57	-0.00	-0.44
14	is pessimistic/ is optimistic	-2.48	0.54	0.16

APPENDIX 49

The loadings of the first 3 components of the elements and constructs derived from the INGRID analysis of the non-gambler STIMULUS GRID.

	ELEMENT The person	COMP. 1 LOADING	COMP. 2 LOADING	COMP. 3 LOADING
1	I am	-0.12	1.26	0.60
2	I would like to be	-2.55	-0.79	0.28
3	I was 5 years ago	1.36	2.60	-0.14
4	I will be in 10 years time	-0.91	0.39	0.06
5	I admire most	-2.45	-0.37	-0.58
6	I dislike most	3.01	-0.66	-0.15
7	I like most	-0.54	0.24	-0.16
8	who usually upsets me	3.01	-0.80	-0.06
9	whom I find comforting	-0.83	-0.09	-0.76
10	whom I find threatening	1.29	-1.47	0.26
11	whose company I enjoy	-1.27	-0.30	0.65
	CONSTRUCTS			
1	does not like/ likes to gamble	1.85	-1.81	0.34
2	does not take/ takes risks	-0.26	-1.01	0.47
3	is usually calm/ tends to worry	2.93	0.37	-0.04
4	does not like/ likes excitement	-1.01	0.66	0.70
5	is not concerned/ fears failure	1.45	1.25	0.22
6	has high/ has low self-esteem	0.92	1.58	-0.12
7	does not need/ needs achievement	1.98	0.16	0.71
8	is not/ is easily aroused	2.18	0.29	-0.25
9	does better alone/ in a group	0.41	-1.47	-0.29
10	has liberal/ conservative outlook	1.76	-0.18	-0.54
11	does not/ believes in luck	0.80	0.29	0.09
12	prefers known/ uncertain outcomes	-0.45	-0.80	0.13
13	is not/ is superstitious	2.18	-0.77	-0.05
14	is pessimistic/ is optimistic	-2.00	-0.24	-0.19

APPENDIX 50

The inter-element relations of the gambler AROUSAL GRID expressed as cosines.

ELEMENT 1 WITH ELEMENT

2 -0.22 3 0.58 4 0.27 5 -0.35 6 0.38 7 -0.64 8 -0.42 9 0.34 10 0.13 11 0.19

ELEMENT 2 WITH ELEMENT

3 -0.84 4 -0.97 5 0.95 6 -0.41 7 0.50 8 0.95 9 -0.71 10 -0.91 11 -0.97

ELEMENT 3 WITH ELEMENT

4 0.85 5 -0.84 6 0.35 7 -0.83 8 -0.95 9 0.84 10 0.73 11 0.83

ELEMENT 4 WITH ELEMENT

5 -0.96 6 0.33 7 -0.54 8 -0.95 9 -0.67 10 0.89 11 0.99

ELEMENT 5 WITH ELEMENT

6 -0.51 7 0.50 8 0.94 9 -0.65 10 -0.93 11 -0.94

ELEMENT 6 WITH ELEMENT

7 -0.08 8 -0.45 9 0.31 10 0.48 11 0.25

ELEMENT 7 WITH ELEMENT

8 0.70 9 -0.84 10 -0.46 11 -0.55

ELEMENT 8 WITH ELEMENT

9 -0.83 10 -0.88 11 -0.93

ELEMENT 9 WITH ELEMENT

10 0.71 11 0.69

ELEMENT 10 WITH ELEMENT

11 0.90

APPENDIX 51

The loadings of the first 3 components of the elements and constructs derived from the INGRID analysis of the gambler AROUSAL GRID.

	ELEMENT	COMP. 1 LOADING	COMP. 2 LOADING	COMP. 3 LOADING
1	decision making	-0.67	-1.10	1.17
2	uncertainty	3.60	-0.60	0.30
3	challenge	-3.35	-1.28	0.17
4	monetary gain	-5.07	0.74	-0.24
5	loss of control	6.02	-0.98	-0.92
6	testing predictions	-0.41	0.10	0.60
7	superstitious behaviour	2.09	2.40	0.35
8	losing money in a bet	5.84	0.63	-0.01
9	risk-taking	-1.70	-1.00	-0.57
10	having a bet	-2.26	0.51	-0.14
11	beating the system	-4.08	0.59	-0.70
	CONSTRUCT			
1	anxiety	1.33	-1.47	-0.28
2	thrill	-4.24	-0.61	-0.76
3	anger	3.10	-0.65	-0.59
4	frustration	3.38	-1.55	0.67
5	interest	-3.71	-0.51	0.74
6	joy	-4.75	0.03	-0.35
7	excitement	-4.38	-0.66	-0.35
8	determination	-2.41	-1.87	0.37
9	depression	2.99	-1.40	-0.21
10	elation	-4.50	-0.28	-0.48
11	remorse	3.09	-0.63	-0.91
12	optimism	-3.04	-0.75	0.50

APPENDIX 52

The relations between elements and constructs expressed as cosines from the gambler AROUSAL GRID.

CONSTRUCT 1 WITH ELEMENT
1 0.04 2 0.65 3 -0.35 4 -0.72 5 0.70 6 -0.12 7 -0.08
8 0.49 9 0.02 10 -0.58 11 -0.69

CONSTRUCT 2 WITH ELEMENT
1 0.03 2 -0.94 3 0.94 4 0.93 5 -0.90 6 0.33 7 -0.73
8 -0.98 9 0.87 10 0.87 11 0.94

CONSTRUCT 3 WITH ELEMENT
1 -0.35 2 0.92 3 -0.77 4 -0.93 5 0.98 6 -0.55 7 0.46
8 0.90 9 -0.61 10 -0.94 11 -0.91

CONSTRUCT 4 WITH ELEMENT
1 0.05 2 0.95 3 -0.66 4 -0.93 5 0.91 6 -0.36 7 0.28
8 0.84 9 -0.58 10 -0.93 11 -0.94

CONSTRUCT 5 WITH ELEMENT
1 0.55 2 -0.91 3 0.95 4 0.92 5 -0.95 6 0.54 7 -0.69
8 -0.98 9 0.77 10 0.84 11 0.88

CONSTRUCT 6 WITH ELEMENT
1 0.34 2 -0.97 3 0.90 4 0.99 5 -0.95 6 0.33 7 -0.65
8 -0.97 9 0.75 10 0.89 11 0.98

CONSTRUCT 7 WITH ELEMENT
1 0.39 2 -0.93 3 0.95 4 0.94 5 -0.93 6 0.36 7 -0.75
8 -0.99 9 0.86 10 0.89 11 0.94

CONSTRUCT 8 WITH ELEMENT
1 0.76 2 -0.66 3 0.94 4 0.68 5 -0.67 6 0.30 7 -0.92
8 -0.83 9 0.82 10 0.54 11 0.66

CONSTRUCT 9 WITH ELEMENT
1 -0.09 2 0.94 3 -0.68 4 -0.91 5 0.94 6 -0.55 7 0.24
8 0.84 9 -0.54 10 -0.91 11 -0.88

CONSTRUCT 10 WITH ELEMENT
1 0.36 2 -0.95 3 0.93 4 0.98 5 -0.93 6 0.26 7 -0.70
8 -0.97 9 0.77 10 0.85 11 0.97

CONSTRUCT 11 WITH ELEMENT
1 -0.40 2 0.91 3 -0.81 4 -0.93 5 0.96 6 -0.57 7 0.40
8 0.91 9 -0.55 10 -0.82 11 -0.88

CONSTRUCT 12 WITH ELEMENT
1 0.55 2 -0.84 3 0.92 4 0.86 5 -0.91 6 0.49 7 -0.77
8 -0.94 9 0.83 10 0.87 11 0.83

APPENDIX 53

The inter-element relations of the non-gambler AROUSAL GRID expressed as cosines.

ELEMENT 1 WITH ELEMENT

2 0.16 3 0.66 4 0.20 5 -0.11 6 0.35 7 -0.70 8 -0.63 9 0.27 10 -0.79 11 0.18

ELEMENT 2 WITH ELEMENT

3 -0.49 4 -0.87 5 0.90 6 -0.72 7 -0.16 8 0.55 9 -0.27 10 -0.70

ELEMENT 3 WITH ELEMENT

4 0.78 5 -0.63 6 0.66 7 -0.68 8 -0.99 9 0.64 10 -0.79 11 0.07

ELEMENT 4 WITH ELEMENT

5 -0.90 6 0.75 7 -0.24 8 -0.83 9 0.43 10 -0.37 11 0.86

ELEMENT 5 WITH ELEMENT

6 -0.87 7 -0.03 8 0.70 9 -0.31 10 0.09 11 -0.72

ELEMENT 6 WITH ELEMENT

7 -0.01 8 -0.70 9 0.18 10 -0.23 11 0.52

ELEMENT 7 WITH ELEMENT

8 0.64 9 -0.67 10 0.87 11 -0.46

ELEMENT 8 WITH ELEMENT

9 -0.67 10 0.75 11 -0.81

ELEMENT 9 WITH ELEMENT

10 -0.56 11 0.59

ELEMENT 10 WITH ELEMENT

11 -0.48

APPENDIX 54

The loadings of the first 3 components of the elements and constructs derived from the INGRID analysis of the non-gambler AROUSAL GRID.

	ELEMENT	COMP. 1 LOADING	COMP. 2 LOADING	COMP. 3 LOADING
1	decision making	-1.09	-1.53	1.17
2	uncertainty	1.88	-1.73	0.34
3	challenge	-3.96	-1.19	0.29
4	monetary gain	-4.08	1.31	-0.42
5	loss of control	3.90	-2.50	-0.55
6	testing predictions	-1.22	0.54	0.71
7	superstitious behaviour	1.39	2.26	0.60
8	losing money in a bet	4.62	1.00	-0.19
9	risk-taking	-1.20	-0.67	-0.96
10	having a bet	1.89	2.34	-0.05
11	beating the system	-2.14	0.18	-0.94
	CONSTRUCT			
1	anxiety	0.34	-2.17	-0.36
2	thrill	-3.63	-0.30	-0.86
3	anger	2.10	-1.66	-0.95
4	frustration	1.72	-2.80	0.79
5	interest	-3.22	-0.94	0.95
6	joy	-3.74	-0.15	-0.31
7	excitement	-3.52	-0.66	-0.10
8	determination	-2.25	-2.02	0.50
9	depression	1.35	-2.06	-0.40
10	elation	-3.53	-0.30	-0.76
11	remorse	1.86	-1.25	-0.45
12	optimism	-2.53	-0.63	0.40

APPENDIX 55

The relations between elements and constructs expressed as cosines from the non-gambler AROUSAL GRID.

CONSTRUCT 1 WITH ELEMENT
1 0.45 2 0.67 3 0.11 4 -0.45 5 0.58 6 -0.42 7 -0.67
8 -0.07 9 0.48 10 -0.55 11 -0.16

CONSTRUCT 2 WITH ELEMENT
1 0.39 2 -0.66 3 0.93 4 0.87 5 -0.74 6 0.62 7 -0.59
8 -0.95 9 0.75 10 -0.63 11 0.92

CONSTRUCT 3 WITH ELEMENT
1 -0.16 2 0.82 3 -0.53 4 -0.78 5 -0.96 6 -0.88 7 -0.15
8 0.60 9 -0.15 10 -0.02 11 -0.56

CONSTRUCT 4 WITH ELEMENT
1 0.44 2 0.95 3 -0.24 4 -0.72 5 0.82 6 -0.58 7 -0.38
8 0.32 9 -0.17 10 -0.31 11 -0.57

CONSTRUCT 5 WITH ELEMENT
1 0.73 2 -0.45 3 0.95 4 0.75 5 -0.62 6 0.74 7 -0.56
8 -0.95 9 0.48 10 -0.80 11 0.65

CONSTRUCT 6 WITH ELEMENT
1 0.47 2 -0.69 3 0.93 4 0.94 5 -0.77 6 0.70 7 -0.55
8 -0.95 9 0.56 10 -0.65 11 0.90

CONSTRUCT 7 WITH ELEMENT
1 0.56 2 -0.56 3 0.96 4 0.84 5 -0.71 6 0.66 7 -0.63
8 -0.99 9 0.71 10 -0.72 11 0.81

CONSTRUCT 8 WITH ELEMENT
1 0.86 2 -0.10 3 0.90 4 0.45 5 -0.26 6 0.40 7 -0.85
8 -0.84 9 0.56 10 -0.91 11 0.52

CONSTRUCT 9 WITH ELEMENT
1 0.21 2 0.89 3 -0.29 4 -0.68 5 0.88 6 -0.77 7 -0.41
8 0.35 9 -0.81 10 -0.31 11 -0.38

CONSTRUCT 10 WITH ELEMENT
1 0.43 2 -0.65 3 0.91 4 0.91 5 -0.73 6 0.61 7 -0.60
8 -0.94 9 0.68 10 -0.66 11 0.93

CONSTRUCT 11 WITH ELEMENT
1 -0.09 2 0.84 3 -0.60 4 -0.85 5 0.95 6 -0.89 7 -0.08
8 0.66 9 -0.13 10 0.10 11 -0.71

CONSTRUCT 12 WITH ELEMENT
1 0.70 2 -0.47 3 0.95 4 0.78 5 -0.69 6 0.72 7 -0.66
8 -0.96 9 0.63 10 -0.72 11 0.73

APPENDIX 56

```
*PROGRAM FOR PROJECTING A 3-D SPHERE ONTO A 2-D SURFACE



*PROGRAM FOR PROJECTING A 3-D SPHERE ONTO A 2-D SURFACE
*** SET PARAMETERS CO IS DISTANCE OF OBSERVER FROM SPHERE
*** C IS DISTANCE FROM SPHERE TO PROJECTIVE SURFACE
          DIMENSION X1(60),Y1(60)
         REAL SP,CP,CT,ST,TPL,TL,CL,SF,TD,T1,T2
          OPEN (UNIT=8,FILE='CHECK')
         CALL MCOPEN('METAFILE',8)
         DATA PI/3.1415926535898 / ,CO/4./,C/2./
         CALL SET(0.,1.,0.,1.,-2.2,2.2,-2.2,2.2,1)
*SET THE LIMITS OF THE OBSERVEABLE SPHERE
         CL=1/(1+CO)
         TL=ACOS(CL)
         SL=SIN(TL)
        SF=((2+CO+C)/(1+CO-CL))
         TD= TAN(PI/2-TL)/6
*PROGRAM SEGMENT FOR COORDS OF LATITUDE LINES
       DO 30 J=1,13
          T1=ATAN(ABS(FLOAT(J-7))*TD)
         ST1=SIN(T1)
         IF (SIN(T1)-.200) 4,5,5
    5    ST1=.19999
    4     T2=PI-ASIN((1+CO)*ST1)
          THETA=SIGN(PI-T1-T2,FLOAT(J-7))
       CT=COS(THETA)
       ST=SIN(THETA)
         KF=0
       DO 20 K=1,33
   16    PHI=FLOAT(K-17)*PI/32
   73    SP=SIN(PHI)
         CP=COS(PHI)
   17   KF=KF+1
       CALL POINTS(CT,ST,CP,SP,CO,C,X,Y)
         X1(KF)=X
         Y1(KF)=Y
         GOTO 20
   18    IF(CP*CT-CL ) 20,20,21
   21    CP=CL/CT
         SP=SIN(ACOS(CP))
         CALL POINTS(CT,ST,CP,SP,CO,C,X,Y)
         X1(1)=X
         X1(KF+1)=X
         Y1(1)=-1*Y
         Y1(KF+1)=Y
         WRITE(8,34) CL,CT,ST,CP,SP
   20    CONTINUE
         CALL CURVE(X1,Y1,KF)
   30    CONTINUE
*PROGRAM SEGMENT FOR LONGITUDE LINES
         DO 50 K=1,13
         T1=ATAN(ABS(FLOAT(K-7)*TD))
         ST1=SIN(T1)
         IF(ST1-.200)63,64,64
   64    ST1=.19999
```

```
*PROGRAM FOR PROJECTING A 3-D SPHERE ONTO A 2-D SURFACE


   63    T2=PI-ASIN((1+CO)*ST1)
         PHI=SIGN(PI-T1-T2,FLOAT(K-7))
   98    SP=SIN(PHI)
         CP=COS(PHI)
         JF=1
         DO 40 J=1,34
         IF(J-34)36,58,58
   36    THETA=FLOAT(J-17)*PI/32
         CT=COS(THETA)
         ST=SIN(THETA)
         IF (CT*CP - CL) 40,38,38
   38    JF=JF+1
         CALL POINTS(CT,ST,CP,SP,CO,C,X,Y)
         X1(JF)=X
         Y1(JF)=Y
         GOTO 40
   58    IF(JF-1)40,40,41
   41    CT=CL/CP
         ST=SIN(ACOS(CT))
         CALL POINTS(CT,ST,CP,SP,CO,C,X,Y)
         X1(1)=(-1.)*X
         X1(JF+1)=X
         Y1(1)=Y
         Y1(JF+1)=Y
   40    CONTINUE
         IF(JF-1)50,50,42
   42    JF=JF+1
         CALL CURVE(X1,Y1,JF)
   50    CONTINUE
           CALL FRAME
          CALL MCCLOS
         END
**SUBROUTINE FOR PROJECTION OF CORDS ONTO SURFACE
         SUBROUTINE POINTS(CT,ST,CP,A1,CO,C,X,Y)
            DATA PI/3.1415/
         B1=1-CP*CT+CO
         C1=CP*ST
         PT=ATAN(C1/B1)
          IF(PT-PI/2) 82,82,81
   81     PT=PT-PI
   82    D1=B1/COS(PT)
         PP=ATAN(A1/D1)
         IF (PP-PI/2) 92,92,91
   91       PP=PP-PI
   92    R=CO+2+C
         RY=R/COS(PT)
         RX=R/COS(PP)
         X=RX*SIN(PT)
         Y=RY*SIN(PP)
         RETURN
  130 FORMAT(9(1X,F6.3))
         END
```